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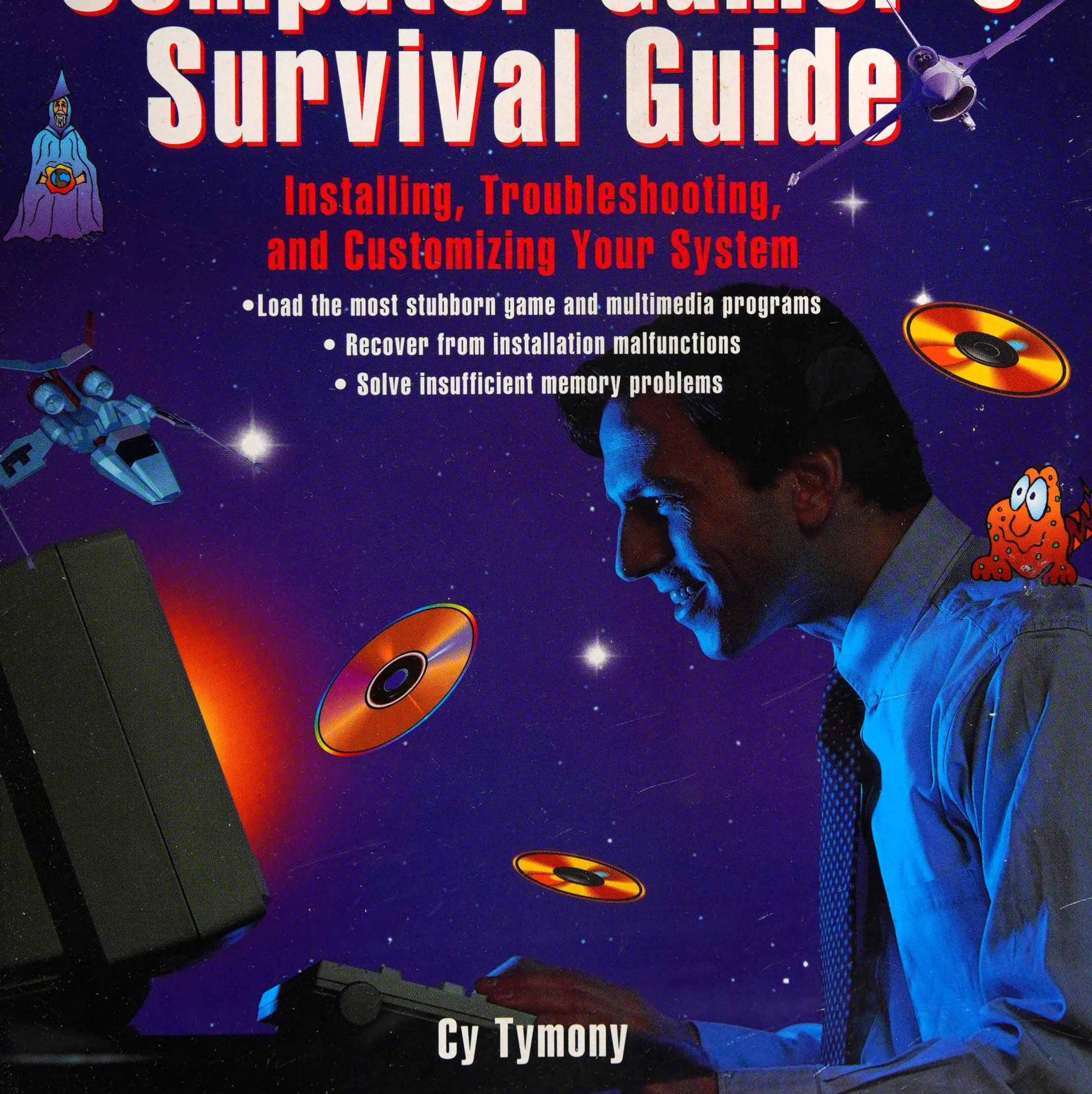
Computer Gamer's Survival Guide

Installing, Troubleshooting, and Customizing Your System

- Load the most stubborn game and multimedia programs
- Recover from installation malfunctions
- Solve insufficient memory problems



Cy Tymony

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Computer Gamer's Survival Guide

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Cy Tymony

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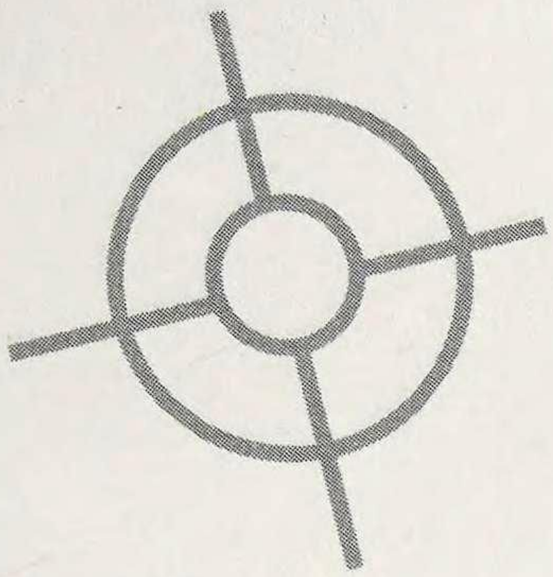

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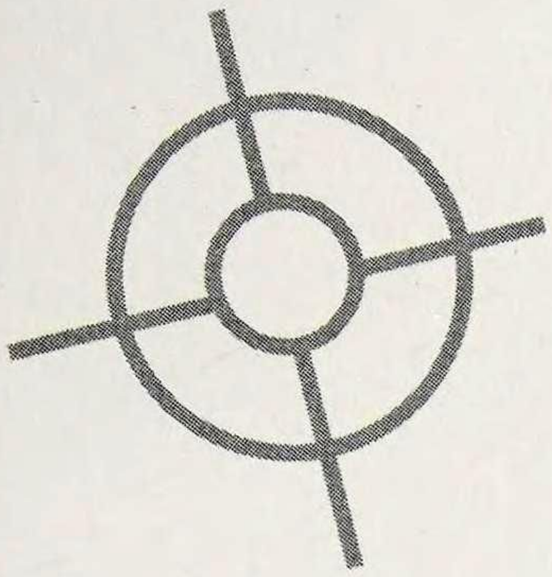

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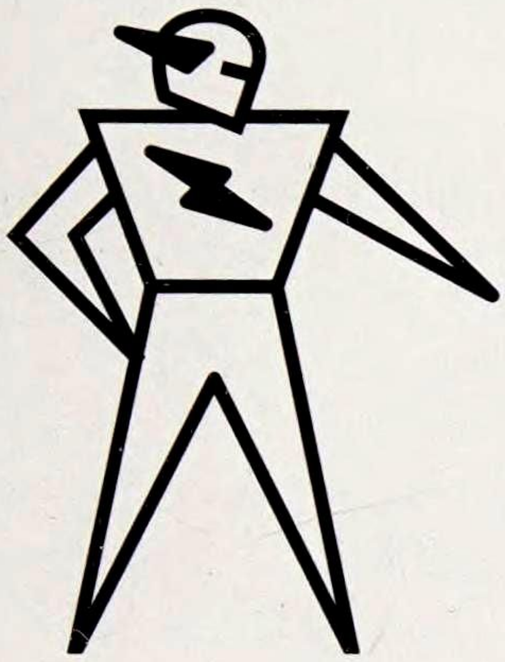
With This Book ...



You can test your mouse and joystick operations with no game running, using a DOS command. See Part 9 for more details.

The PC sound card can be the root cause of your CD-ROM drive failing. See Part 5 for more details.

You can gain more conventional memory by simply changing the order of lines in your AUTOEXEC.BAT file. See Part 3 for more details.

You can load and unload the MOUSE.COM device driver in memory *without* rebooting! See Part 9 for more details.

There are three procedures you can perform to maximize your PC memory *after* running MemMaker. See Part 3 for more details.

Stacker versions 3.1 and 4.0 use DOS 6 DoubleSpace files to operate. See Part 6 for more details.

If you want to see hidden files in a directory listing, type **DIR**, and press Enter. See Part 6 for more details.

You should *not* install Windows games in your present copy of Windows. See Part 8 for more details.

Introduction

Loading game software instills a sense of anticipation and emotion that no other PC program can match. The feeling of entering a new, exciting, interactive world makes business applications pale in comparison. The flip side is that game-loading problems cause much more disappointment than other programs.

You may ask yourself, "Why would I need a book just for loading games? Shouldn't the instruction manual for the game be enough?" Unfortunately, no. Game software instructions are sometimes included on a single sheet of paper listing minimal startup procedures, while others come with no instructions at all. Some games include instructions in a README.DOC file on the disk.

Most game software instructions are produced after the program is completed, as it is being rushed to market. The manuals are usually written by techies who are very familiar with the game—but knowing a lot about a product can be a negative when it comes to writing instructions for those who don't.

Why This Book Was Written

1. Pre-installation safety procedures are *critical* for keeping your PC in good working order. Even if there is decent documentation for a game, there are too many different possible PC setups for a company to address all of them. The potential for compatibility problems with system memory, installed hardware, device drivers, and video modes is enormous.
2. Many game programs install themselves into your PC and make changes to important system files in DOS and Windows, and sometimes even to your computer hardware settings. Critical problems can result from these modifications. Some game documentations recommend making a "boot disk" to load their product, but they don't foresee the mistakes that users can make while creating the disk, often making problems in their hard disk files. Many games alter a sound card's hardware configuration or its sound output levels. This can cause sound problems with other game programs and possibly even disable a CD-ROM drive connected to it! Game users need help isolating and identifying problems so they can restore their PC's setup environment to its pre-game mode.
3. Even when you do everything right, some games still won't run. There may be a bug in the program or known conflicts with hardware drivers that require a patch program to fix the problem. In these cases, you need to call for tech support. But who do you call? The PC maker? The game company? The manufacturer of a peripheral's driver software? And how do you get the proper support you need? Many support technicians will query you about *any* modification made to system files by a hardware peripheral or an accessory program you may have installed (e.g., a screen saver, a Windows shell, wallpaper, a disk compression program, or a memory manager program). If you tell them that you have added any of these programs, they'll usually stop troubleshooting and refer you to another company's support line. What if there is no phone support available for the game—or what if you can't get through because it's always busy? You should know alternative ways to obtain tech support.

4. The games, they are a changin'. During installation, WordPerfect 6 now asks for a sound card type. More and more business applications can embed sound and video presentations. Virtually all educational software includes audio and video animation. Even screen savers can now be programmed for character movement trajectory and can play user-defined audio files. The most historic change is the multimedia revolution that has taken hold. Millions of multimedia computers are being sold every year. So are multimedia upgrade kits for older PCs.

The multimedia revolution has not only spawned an increase in application titles from computer software companies; *every* branch of the media industry is working overtime to produce CD-ROM products to gain market share in their category. You can find books, music videos, photos, movies, comic books, magazines, adult-only entertainment, and instruction and business topics all on CD-ROM. In their rush to position multimedia products on shelves, many companies overlook designing them for low memory requirements and testing them for compatibility with a myriad of device drivers and PC configurations.

Why Should You Buy This Book?

Although game programs used to have low memory requirements and loaded easily with the system files that were already installed, games have gotten much more complex and memory-intensive than they used to be. Keep in mind that the original IBM-PC was not designed to use a mouse or joystick, to generate graphics, or to produce any sound other than a beep. Now we expect PCs to deliver a dazzling array of video, animated graphics, stereo sound, and speech, all manipulated with mice, joysticks, and other exotic controllers.

Additionally, PC game manufacturers expect your system to have nearly all of your conventional memory (the memory area from 0 to 640K) available for game playing. Unfortunately, most modern PCs already have plenty of small programs and hardware device drivers occupying that area—for example, MS-DOS, the extended memory driver, and mouse, video card, sound card, and CD-ROM drivers.

That's why it isn't unusual to have 30 percent of your games fail to load properly the first time. In other words, if you play computer games regularly, you are almost guaranteed to run into compatibility problems.

When you have a PC game-loading problem, where do you find good technical help? A Windows book? A DOS guide? A memory management book? You could read these massive texts and learn a lot about PC operating systems, hardware design, and the history of PCs—and still not find the answers you're seeking. This is the first book to focus on game-loading issues. *Computer Gamer's Survival Guide* will help solve your PC game-loading problems and maintain your PC's configuration.

How Is This Book Different?

Computer Gamer's Survival Guide gives you the information you need to get your PC game programs loaded and running right. It is designed to cover technical issues in a clear, concise format and includes illustrations and screen shots. You'll find many little-known and undocumented tips that will help you load *all* types of software programs. Specific game titles and manufacturer names will not be mentioned, because each situation is different. But you'll recognize your particular problem from the symptoms described. Virtually every game-loading problem is covered here.

What You'll Learn and What You Should Know

This book will *not* give you a complete technical overview of MS-DOS, Windows, or PC hardware design. There are plenty of good books on these topics (see the reference section for a list of recommended titles). *Computer Gamer's Survival Guide* focuses only on PC game-software loading issues. Therefore, you will *not* find extensive information about printers, modems, or existing hardware problems. The text presumes you have a good running PC with a good set of MS-DOS 6.2 (or higher) disks.

How Games Affect Your Computer

Games do not alter your PC's hardware; they only change the software files and system settings. Although this book will include some hardware advice, it primarily covers troubleshooting tips and solutions to software-related problems. Basically, if your computer can boot up and display a C:\ prompt on the screen, you don't have a hardware problem. Or if you can boot up with a DOS disk in your A (or B) drive, type **C:**, and get a C:\ prompt, you just have a software-related problem. Your PC hardware is assumed to be in good condition *before* you load a game.

This book is designed to provide you with fast access to solutions for your game-loading (and post-installation) problems. After you fix the problem at hand, I suggest that you read every section of this book when you have time. Game-related problems can show up in the most unlikely places. One area of your computer's configuration can have an adverse, direct effect on another.

For example, your sound card setup can cause a malfunction with your joystick and CD-ROM drive. Just one extra device driver can make available memory insufficient for loading games. Performing memory optimization can cause a video driver not to load. A recently installed video driver can prevent Windows from starting. Even a *successful* game installation can alter your PC's CMOS settings and possibly rewrite or delete the AUTOEXEC.BAT and CONFIG.SYS files—and they control your *entire* system.

There's no need to memorize every issue given throughout the book. But having an overview of how PC hardware and software are related can cut down your troubleshooting time and prevent future mishaps. This leaves more time for enjoying games!

Read the "Before You Begin" section that follows, check the Question-and-Answer section for your particular game-loading problem, and try the answer given. For more details on the problem, check the chapter reference at the end of the answer.

And now . . . Let the games begin!

Questions and Answers

For more information about the subject covered in a given question, check the chapter reference at the end of the answer.

Q Why are PC game programs so difficult to load and run compared to other software programs?

A A standard business program such as a word processor or database program doesn't require high resolution, animated graphics, stereo sounds, and voice effects. For a game to load properly, it requires a lot more conventional memory to be available on startup. Conventional memory is the memory area from 0 to 640 kilobytes (K). There are small programs called device drivers and utilities already loaded in conventional memory. To see a list of the programs running on your system and how much memory they are using, type **MEM/C/P** at the DOS prompt. The "largest executable program size" statement indicates the amount of memory available for your game program. See Part 3: Memory Issues.

Q I have 4 megs of RAM on my motherboard and my extended memory manager is loaded (HIMEM.SYS). Yet, nearly half of my game programs require configuring my CONFIG.SYS file to make expanded memory (EMS) available. Why do so many games require expanded memory in order to load?

A That can be answered with two words—*backward compatibility*. PC owners with 8088 and 8086 processors cannot use extended memory and would be unable to load and run games that require more than about 500K available. Before the extended memory system (XMS) was developed to allow access to memory above 1 MB, PC owners had to install a memory board in an open expansion slot and load a device driver to access that memory. This was how the expanded memory (EMS) standard was developed. Owners of 386, 486, and Pentium PCs can load a DOS device driver called EMM386 in their CONFIG.SYS file to allow their extended memory to be utilized as expanded memory for game programs that need it. See Part 3: Memory Issues.

Q A game program needs 2.5 MB of expanded memory available. I've set up my EMM386.EXE driver line in my CONFIG.SYS file as follows: DEVICE=C:\DOS\EMM386.EXE RAM 3072. Every time I check the available memory, only 2 MB of expanded memory is available. What gives?

A Check your AUTOEXEC.BAT file for a SmartDrive statement. A typical line would be C:\DOS\SMARTDRV.EXE 1024 256. If you see a line like this, the SmartDrive disk cache program is taking 1 MB (1024K) of memory for its own use. To load your game, you can step through your AUTOEXEC.BAT a line at a time on bootup by holding down the F8 key (with DOS 6.2). When you get to the SmartDrive line, answer N for No to skip over it. You could also lower the amount of memory SmartDrive uses by editing the line to read C:\DOS\SMARTDRV.EXE 512 256. Another option is to use the DOS 6 MultiConfig capability to provide a menu of different startup options. See Part 3: Memory Issues, for more details.

Q I have DOS 5 and the most conventional memory I can obtain with the mouse loaded is 520K. How can I obtain more free conventional memory?

A The single most useful tool for game users is DOS 6.2. By default, you'll be able to load more programs into upper memory. It allows you to process the CONFIG.SYS and AUTOEXEC.BAT files one line at a time, so you can leave out certain drivers on certain sessions. DOS 6.2 also includes an automatic memory management program (MemMaker) and a disk-compression utility (Doublespace) to free up hard drive space. For more details on DOS 6.2, see the "Before You Begin" section.

Q I loaded the DOS 6 MemMaker utility program and it increased my conventional memory available (from 532K to 609K), but now Windows will not load. I know that I can run the MEMMAKER/UNDO command, but I need the extra memory free. What can I do?

A The MemMaker program probably altered the EMM386 statement in your CONFIG.SYS file. Luckily, MemMaker copies your original CONFIG.SYS file to the DOS subdirectory on your hard drive and renames it CONFIG.UMB (It does the same thing to your AUTOEXEC.BAT file, too; look for AUTOEXEC.UMB). If you compare your root directory's CONFIG.SYS file to the CONFIG.UMB file, you'll find that the EMM386.EXE line has been shortened. A typical line would appear as follows:

```
DEVICE=C:\DOS\EMM386.EXE NOEMS X=C901
```

X=C901 is an exclude statement to reserve a portion of memory for video RAM. After you load MemMaker, this line will likely appear as:

```
DEVICE=C:\DOS\EMM386.EXE NOEMS HIGHSCAN
```

The HIGHSCAN statement allows MemMaker to scan aggressively for upper memory areas. After you edit the EMM386.EXE line statement back to its original state, save the file, and reboot the PC, your Windows program should load fine. See Part 3: Memory Issues, for advanced MemMaker information.

Q I ran the DOS 6 MemMaker utility and it increased my available conventional memory to 597K. Can I get more memory available?

A Yes. First, save your original CONFIG.SYS and AUTOEXEC.BAT files to diskette and print them out for reference. Although MemMaker does a good job of automatically locating upper memory areas in which to load device drivers and utility programs, it does not change the loading order of these programs. A program may need much more memory free to initially load than it needs after loading. If you alter the program loading order (by editing your CONFIG.SYS and AUTOEXEC.BAT files), MemMaker can possibly gain more conventional memory free. For more details, see Part 3: Memory Issues.

Q Since many games take up a lot of hard drive space and require large amounts of conventional memory free, can I run a memory management program with a disk compression program like Stacker or Doublespace?

A You can run the DOS 6 utility programs MemMaker and Doublespace together. Before running one commercial memory management program with a disk compression program, *make sure* that the manual states they are compatible together. If the manual has no reference to another utility, you should call the technical support line to be sure. See Part 11 for information on getting the most from technical support departments.

Q Some of my DOS games don't run properly in Windows. They either crash or have sound problems. What's wrong with Windows?

A DOS games should never be run in Windows. Windows is very memory- and device driver-intensive. It doesn't like to relinquish control of memory and the sound card (that's why you may receive a "sound contention error" message when you attempt to run DOS games). Even if some of your DOS games seem to run fine, it's not a good idea to run them in Windows because if they crash, they can corrupt your Windows files. See Part 8: Windows Troubleshooting, for more information about the Windows environment.

Q Why do many DOS games need a VESA driver installed before they will run, and how can I get the driver?

A A VESA driver is a program that works with your DOS game program to produce high-resolution color graphics. The Video Electronics Standards Association created a standard for Super VGA graphics for PCs in 1988. The VESA drivers are available from the PC manufacturer, the video card maker, and most online services. See Part 4: Video Issues.

Q I've loaded a VESA driver on my machine for my DOS games and I started it by typing **HTVESA.COM**. The game still looks scrambled. Why?

A Some VESA driver programs can be loaded in more than one page mode. You can load that particular driver in two ways. At the DOS prompt. type **HTVESA/1** or **HTVESA/2** and try your game again. One of these page modes should provide a good video image. See Part 4: Video Issues, for more details.

Q Every time I run a particular game it loads fine, but the screen blacks out after startup. The game doesn't require a VESA driver or expanded memory, and I have ample conventional memory available to run it. Why does it black out but not give an error message?

A Some game programs scan your system hardware to determine what kind of video card you have, and they are not always successful. Another possibility is that the game crashed while it was loading. See if you can enter your game program's setup or configuration menu to change the video type. If this is not possible, contact the game's technical support line for assistance. See Part 4: Video Issues, for more details.

Q I have a couple of Windows games that run, but they sometimes appear distorted and stretched out. I am running the proper Windows video driver specified. What's wrong?

A Some Windows games use the QuickTime compression method for producing high-resolution graphics. Go to the Windows subdirectory in the File Manager, and you should find a file called QTW.INI. You can edit this file (just double-click on it or use the DOS Editor) and make sure that the [VIDEO] section of the file contains a line that states OPTIMIZE=DRIVERS. The line may read OPTIMIZE=HARDWARE. If it does, change it. If there is no such line, create one, save the file, and restart Windows. The video graphics should appear fine. See Part 8: Windows Troubleshooting, for Windows environment tips.

Q When I started a certain Windows game, I got this error message: **DMABufferSize is too small. Set to 34**. What do I do to correct this?

A You need to edit a line in your C:\WINDOWS\SYSTEM.INI file. Use the DOS Editor or the Windows Notepad to do this. In the file, locate the [386Enh] section and find the line that says DMABufferSize=*xx*. You must increase the number (*xx*) to the number that the game program recommends. If you do not see a line like this, create one (be sure to make it look like it does here, with the same capitalization), save the file, and restart Windows. The game should now load normally. See Part 8: Windows Troubleshooting.

Q After I installed a game and configured it for my sound card, I got a repeating tone in Windows. How did this happen?

A It's possible that your game program altered your sound card IRQ settings for Windows. To check this, change to your sound card's software subdirectory and look for a Utility directory. In that directory, you'll find some sort of CONFIG.EXE file (possibly under SBFIG.EXE, SGFIG.EXE, or a similar filename). When you type the filename at the DOS prompt, you can check your IRQ settings. You can also check these settings in the Windows Control Panel; double-click on the Drivers icon. In the Drivers window, highlight your sound card driver(s) and click on Settings. Make sure that the IRQ setting is set properly in each sound driver file. See Part 8: Windows Troubleshooting, for more information.

Q I have a CD-ROM drive but no sound card. Is there any way I can hear the sounds from the CD-ROM?

A Yes, there are two possible solutions. If there is a headphone jack on the front of your CD-ROM drive, you can connect headphones or amplified speakers to this jack and hear your CD-ROM sounds.

(continued)

There is also a way for your PC's internal speaker to emulate a sound card. First you must download it from an online service called PC-SPEAKER, which is accessible from CompuServe (type **CIS:PC-SPEAKER**). After you download this file and load it into the Drivers section of your Windows Control Panel, you'll be able to hear Windows sounds. If you later get a sound card, you'll want to remove PC-SPEAKER from the Drivers list, because some of your Windows sounds will not be available until you do. See Part 5: Sound Problems and Solutions, for details.

Q One of my game programs will not produce sound from my sound card. All of my other games and Windows programs produce sound. What could the problem be?

A Check the game program's Setup or Install menu and check the sound card settings configuration. You'll probably find incorrect settings. To be sure, check your sound card manual or its configuration utility program for its present settings. If you cannot check the sound card from the game setup, then call the company's technical support line for further instructions.

One other sound problem with games can occur if the sound card levels are set too low. Check your sound card's configuration utility program and set all of the sound levels (FM, Voice, CD-Audio, Line-In, etc.) at half their maximum. See Part 5 for more sound tips.

Q I have a multimedia kit. After a family member was working with it, my CD-ROM drive stopped working. I've checked my AUTOEXEC.BAT and CONFIG.SYS files and they are okay. What could be wrong?

A Go into your sound card driver utility subdirectory, find the setup configuration file, and check the CD-ROM settings to make sure they are set for your particular CD-ROM type (check your CD-ROM and sound card manuals for more details). It's very likely that the type specified does not match your brand of CD-ROM or that it is not enabled at all. See Part 5 for more details.

Q After I upgraded to DOS 6.2 (from DOS 5.0), the CD-ROM drive that I had installed earlier became unavailable to me; I get the error message **Incorrect DOS version**. What is wrong? I still want to take advantage of the newer DOS utilities.

A You should check your AUTOEXEC.BAT file for the line that includes the MSCDEX.EXE file. A typical line looks like this:

```
C:\MMPRO16\MSCDEX.EXE /D:MSCD0001 /M:30 /E
```

The CD-ROM drive MS-DOS device driver is the MSCDEX.EXE file. Your CD-ROM drive kit included an older version of that file and it is loaded in your sound card's subdirectory. DOS 6.2 includes a new version of that file. When your AUTOEXEC.BAT tried to load the earlier version of MSCDEX, it conflicted with DOS 6.2. To redirect your file to use the new DOS version, simply change your AUTOEXEC.BAT file line from C:\MMPRO16\MSCDEX.EXE to C:\DOS\MSCDEX.EXE. See Part 6: Storage Issues, for more CD-ROM drive tips.

Q I've purchased a game program disk that has no instruction manuals. How do I find out how to load it and use it?

A Most game program diskettes come with a README.DOC or README.TXT file on them. If you don't have an instruction manual, you can view these files with any word-processing program to obtain the game-loading instructions. See Part 2: Assessing Games and System Requirements, for more pre–game-loading tips.

Q One of my older DOS games runs much too fast on my 486SX machine. I don't have a Turbo button on my PC to slow it down. Is there any way to play this and other DOS games?

A Check your PC manual for a Turbo speed change key command (e.g., Alt+Ctrl++= or some other combination). If that information is not listed in your manual, then call your PC manufacturer for more information. Alternatively, a program called AT-SLOW, which you can get from an online service, can slow down your PC game-playing sessions. See Part 2.

Q I have Doublespace running on my PC, and some of my game programs have poor graphics. I've seen the same game run properly on my friend's identical PC, which does not have Doublespace running, and it looks okay. Can I make it run properly on my PC with Doublespace?

A Yes. Some programs do not run well on a Doublespace section of your hard disk, but there is still a non-compressed section of your hard drive that you can load to. You should enter the Doublespace program and use the Change Size command from the DRIVE menu to make enough room on your non-compressed drive (usually called H or I). Once you have enough disk space free, you can load the game into a directory on the uncompressed drive (e.g., H:\GAME).

Also, copy your AUTOEXEC.BAT and CONFIG.SYS files to the H drive along with your DOS files (make an H:\DOS directory for them to be loaded in first). With DOS 6.2, you can then boot up the PC without Doublespace running by holding down the key combination Ctrl+F8 during startup after you see the **Starting MS-DOS** message. You'll be prompted to process all of the lines in your AUTOEXEC.BAT and CONFIG.SYS files. Just choose **(Y) to all**. At the DOS prompt, you can change to your game directory and start the game. (You will not have access to your Doublespace drive C until you reboot the computer normally.) See Part 6 for hard drive optimization tips.

Q My mouse works fine in Windows, but when I exit and start up my DOS games, the mouse doesn't appear. Why does it disappear?

A Windows loads its own mouse driver for its own internal use. For DOS programs, the mouse needs a mouse driver loaded either manually or as a statement in the CONFIG.SYS (DEVICE=C:\MOUSE\MOUSE.SYS) or AUTOEXEC.BAT file (C:\WINDOWS\MOUSE.COM). To manually load the mouse driver from the DOS prompt, change to your Windows directory (type **CD\WINDOWS** and press Enter) and type **MOUSE**. See Part 9 for more troubleshooting tips.

Q Help! After I load a game program and reboot the computer, I have to enter the time and the date and I cannot load Windows. What's wrong?

A This is an all too frequent post–game-loading problem. Sometimes during the game-loading process or while making a boot disk, your CONFIG.SYS and AUTOEXEC.BAT files become damaged or get renamed. You can examine your directories for another copy of your two system files and rename them properly (e.g., enter **REN CONFIG.OLD CONFIG.SYS**). See Part 1: Before You Begin, for more recovery tips.

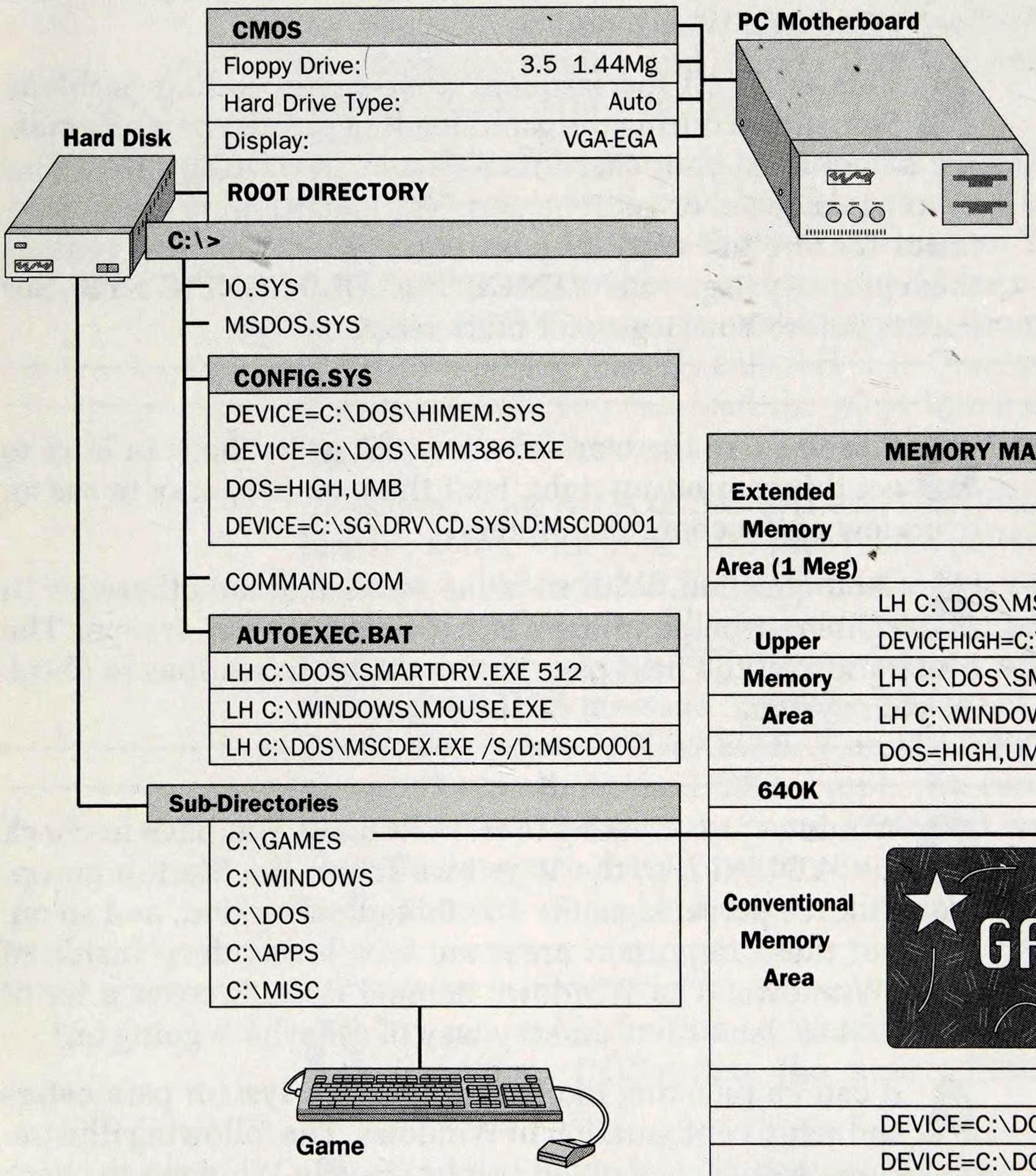
Q It seems like there are so many things to check in DOS to get things running right. Isn't there an easy way to see an overview of the computer system?

A Good question. With so many items that are otherwise in visible, it helps to have a map view of your system. The illustration on the next page shows the basic sections to check on your system.

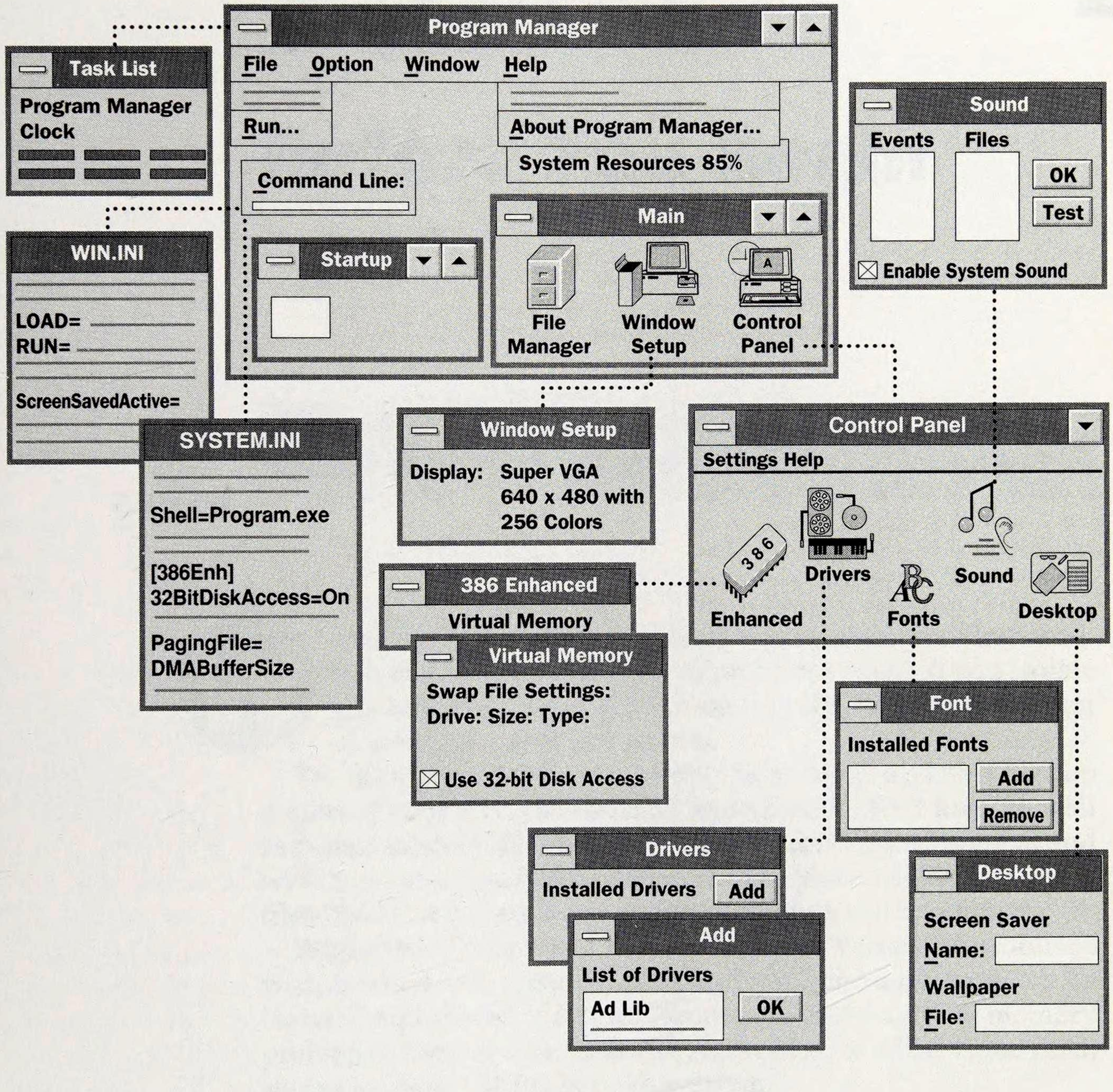
Q Windows is confusing to troubleshoot! You have to check the WIN.INI file, the Windows setup, the Startup group, the Resource percentage, the 386 Enhanced section, and so on. Some of these important areas are four levels deep inside of other Windows! The Windows manual doesn't cover a lot of these issues. Isn't there an easy way to see what's going on?

A It can be puzzling to check important system parameters and setup configuration in Windows. The following illustration shows a map view of the crucial areas in Windows to check when troubleshooting software problems. For more Windows tips, see Part 8: Windows Troubleshooting.

A map view of the PC's CMOS and bootup files—the basic sections to check on your systems.



Windows troubleshooting map view.



Part 1

Before You Begin

Before you load any game, read this chapter. It will give you the essential tools to prevent potential problems.

When troubleshooting problems with games, you first need to isolate and identify where problems occur. If you isolate and monitor startup procedures you'll get a good indication of where the problem occurs.

The best way to prevent trouble is to keep updated backup copies of your AUTOEXEC.BAT and CONFIG.SYS files, as well as copies of all of the files from your Windows directory that end with the extensions INI, GRP, and INF. Make backups of these files *before* you install any program or run a utility program.

While there may seem to be an endless variety of problems with loading and running game software, most of them can be isolated and traced to a few common causes—notably memory problems; incorrect settings in system files; or a bad video card, sound card, or CD-ROM device driver.

This section will show you how to get past loading problems, keep track of your system configuration files, and recover from any post-installation mishaps that occur.

In some cases, bypassing or changing a single line in your AUTOEXEC.BAT or CONFIG.SYS file will get you up and running.

Essential Troubleshooting Tools

You'll need three basic things in order to troubleshoot and correct game-loading problems. Before you go any further, check the list below. These essentials virtually ensure that you'll be able to load any game that is bug-free and contains no corrupted files.

1. **A good running system with no hardware problems.** Needless to say, all of the software that you try to load can only run as well as the PC it is installed on. Any current hardware problems, bootup difficulties, or software conflicts must be resolved *before* you can have a chance to load a problem application.
2. **A basic knowledge of MS-DOS.** MS-DOS stands for **M**icro**s**oft **d**isk **o**perating **s**ystem. MS-DOS is the software program that performs all of the housekeeping operations in most PC-compatible computers. Its basic function is to perform the startup functions of the PC and to keep track of applications that are running. Application programs make "function calls" to DOS to get the PC to perform certain tasks.

   You don't have to be a computer programmer or know every MS-DOS command, but there are some basic functions you should know how to perform. Since program file editing and copying is necessary for some of the solutions given in this book, you should be familiar with simple MS-DOS commands and know how to move around in Windows.

   Before using the tips in this book, you should know how to copy, delete, or rename a file; make a bootable floppy diskette; create, delete, and move between directories; check a file listing on a diskette; and use the DOS EDIT program (a simple word processor included with DOS) to edit files. All of these basic functions are covered in your MS-DOS manual. I've included some basic DOS and Windows commands and procedures at the end of this chapter as a convenient quick-reference guide. Read your DOS manual for more details on commands and utility operation instructions.

3. ***Good*** **copies of DOS 6.2 (or higher) and Windows 3.1** (for Windows games only) **and the *latest* device drivers** for the hardware accessories installed on your computer—e.g., the mouse, video card, sound card, and CD-ROM. To alleviate inexplicable lockups and erratic operation, you need to ensure that your core DOS files are in good working order. To reinstall MSDOS.SYS, IOSYS.SYS, and COMMAND.COM on your hard disk, put in your MS-DOS disk #1 in drive A and type **A:** and press Enter. Then type **SYS C:** Enter. NOTE: If you have Stacker 3.1 (or higher) installed, *do not* type the SYS C: command. See the "Disk Compression Issues" section for more details.

Why You Need DOS 6.2

You must have a good copy of MS-DOS 6.2 (or higher) to solve most game problems. It is an *essential* troubleshooting tool, and the tips I give in this book require that a good working copy is installed. Even DOS 6.0 doesn't have all of the capabilities necessary. DOS 6.0 owners can download a copy of the 6.2 (and up) upgrade for free from the Microsoft Download Service (a bulletin board service, or BBS) or from CompuServe on the Microsoft Forum. See the reference section of this book for more information.

No previous version of MS-DOS (or other operating system) includes as many timesaving troubleshooting tools with a built-in memory management program. A partial list of the new features in DOS 6.2 is given later in this chapter.

- Until DOS 6.2 was released, to bypass just one line in either the CONFIG.SYS or AUTOEXEC.BAT files, you had to start up a word processing program, edit the file, save it, exit, and reboot the computer. Then to return the file to its original state, you had to perform the same process all over again! With DOS 6.2, you simply hold down the F8 key at startup time and you can bypass any line you want. The PC will start up normally the next time with no intervention needed. This makes creating game "boot disks" obsolete.
- If you have the DOS 6 (and higher) Doublespace or Drivespace compression program installed, you can completely bypass running the compression utility for a session by holding down the Ctrl+F8 keys at startup time.

Using this method, you can load some games when the conventional memory is too low. Plus, there is an Uncompress utility included so you can uncompress the hard disk in one step (this isn't available with DOS 6.0).

- Most game users must have different files loaded in the CONFIG.SYS and AUTOEXEC.BAT files at startup time for different games. DOS 6.2 allows you to make a simple MultiConfig menu file to handle this. You can create a startup menu to prompt you to select which startup configuration you'd prefer on this session. Now every user can easily hit a key for their desired applications without needing to know any technical parameters. For more information, type **HELP MULTI-CONFIG** at the DOS prompt.

These are just a few reasons why DOS 6.2 is absolutely necessary for working with problem games. DOS 6.2 also includes the following capabilities:

- An automatic memory management program (MemMaker)
- A disk compression program (and a way to *un*compress a disk)
- A defrag utility to consolidate file locations on your hard disk
- An antivirus program
- An improved undelete utility
- An improved Smartdrive disk cache utility that can cache CD-ROM drives
- A backup program for DOS and Windows
- A diagnostic utility (MSD) to view memory usage and hardware accessory activity.

The latest version of MS-DOS also includes improved device drivers for memory management (HIMEM.SYS, EMM386.EXE) and for CD-ROM drives (MSCDEX.EXE).

See the "Memory Issues" section (Part 3)for more information on working with DOS 6.2.

Updating Device Drivers

Many problems can be alleviated just by obtaining and installing updated device drivers! Contact the manufacturers of all of your hardware accessories via letter, phone, or BBS. Check the reference section at the end of this book for a list of company names and addresses. Check with the makers of your accessories at least twice a year for updates and ask about known conflicts and problems with certain programs and other hardware.

Assumed Conventions

Directions for this book will be given with the assumption that you load diskette applications and files in your drive A (A:). If you need to load from the B drive, follow the same steps but use drive B (B:).

The hard disk installed in your computer is assumed to be drive C (C:). If the hard disk in your PC has a different letter designation, substitute that letter.

The MS-DOS directory on your hard drive is assumed to be loaded in the C:\DOS directory. If it is located in another directory, substitute the appropriate directory (for example, C:\NEWDOS).

The Windows directory on your hard drive is assumed to be located in the C:\WINDOWS directory. If your working Windows program is located in another directory, substitute the printed reference for the appropriate directory (for example, C:\WINGAME).

The CD-ROM drive is referenced in the text as drive D. Substitute another drive letter if necessary.

A *TSR* (**T**erminate and **S**tay **R**esident) program loads into memory and stays there working in the background.

A *device driver* is software designed to let add-on devices communicate with your PC-compatible computer. This allows you to continually expand the capabilities of your PC while retaining compatibility with the original IBM PC standard. Without device drivers, your PC couldn't take advantage of newer innovations such as a mouse, sound card, image scanner, or CD-ROM drive.

Files You Should Back Up

You can lose your software and hardware configuration settings on your hard disk *at any time*. You should *always* have backup copies of your application programs, game software, and personal files.

Before proceeding, you should back up the CONFIG.SYS and AUTOEXEC.BAT files from the root directory of your hard disk. A printed copy of these files is also recommended. Since games and other software installation programs rewrite these files, it is important to have a starting reference point to which you can always return if you need to recover your PC's original configuration setup. Your MS-DOS manual covers these two files in detail.

Checking typical CONFIG.SYS and AUTOEXEC.BAT file listings.

System Configuration Editor

File Edit Search Window

C:\AUTOEXEC.BAT

```
PATH C:\DOS;C:\WINDOWS;C:\DOS\C:\
SET BLASTER=A220 I5 D1 T3
set TEMP=C:\WINDOWS\TEMP
@loadhigh C:\DOS\SHARE.EXE /l:500 /f:5100
C:\DOS\SMARTDRV.EXE
```

System Configuration Editor

File Edit Search Window

C:\CONFIG.SYS

```
DEVICE=C:\DOS\HIMEM.SYS
dos=high,umb
DEVICE=C:\DOS\EMM386.EXE NOEMS
files=30
LASTDRIVE=F
FCBS=4,0
BUFFERS=10,0
STACKS=9,256
DEVICEHIGH=\DEV\HITACHIA.SYS /D:MSCD001 /N:1 /P:300
```

CONFIG.SYS *confi*gures your *sys*tem, and AUTOEXEC.BAT *auto*matically *exec*utes a *bat*ch file list of commands every time you turn on your machine. You need to view and find the purpose of *every* line in these files so you'll know what they control in your machine. Most of the game-loading problems concerning insufficient memory can be resolved by simply bypassing some of the lines in these files. See your DOS manual or the "Memory Issues" section of this book to learn about the selective startup procedure.

Your MS-DOS manual will explain the functions of most of the files displayed in your CONFIG.SYS and AUTOEXEC.BAT files. There may be other lines in the files whose function is not apparent. They were probably placed there by a software utility program (like a virus checker, a memory manager, or a screen saver). Other lines are written to these files by hardware accessory installation software (e.g., for the sound card or the CD-ROM drive).

You should also have at least two copies of any hardware device driver and utility software that controls your peripherals. Sometimes the fastest way to get your sound card or CD-ROM drive working again is simply to reinstall the driver using the original installation diskettes. Also keep good backup copies of software for non-game-oriented installed hardware (e.g., a scanner or printer) in case those drivers need reloading.

Windows users should also keep backup copies of the files in the Windows directory that end in the extensions INI, GRP, and INF (e.g., SYSTEM.INI, MAIN.GRP, 123.INF). These files configure and set up the Windows environment and are rewritten by games and other Windows applications. If you reinstall Windows to recover from a failed program installation, it will not appear or operate the same unless you copy these files back into the Windows directory.

Keeping Track of File Changes

Tracking system file configuration changes is just as important as backing them up. It isn't difficult to see changes made to the CONFIG.SYS and AUTOEXEC.BAT files, because both files are short. But other important files, like Windows' WIN.INI and SYSTEM.INI, are too long and obtuse to let you easily find post-installation changes. Luckily, there is a little-used DOS command available to display the differences in files.

The File Compare command, FC, compares and displays the differences between files so that you can log before-and-after lines. The file compare command can be run with many different optional switches. This is the one used most often for comparison:

```
FC /L/N  1st Filename  2nd Filename
```

The /L switch compares the files as ASCII text. (ASCII is the standard code used for text transferral between computers.) The /N switch displays the ASCII file line numbers.

For example, before installing a game or another software application, you should first back up and rename the original CONFIG.SYS and AUTOEXEC.BAT files (e.g., CONFIG.OLD). For a Windows application, also back up and rename all of the files with the extensions INI, GRP, and INF. For instance, back up the WIN.INI, MAIN.GRP, and OEMSETUP.INF files. Then install the application program.

To compare the old CONFIG.SYS file with the new version, change to the root directory by typing **CD** Enter. Then type **FC /L/N CONFIG.SYS CONFIG.OLD**. This is a typical file comparison display:

```
C:\>FC /L/N CONFIG.SYS CONFIG.OLD
Comparing files CONFIG.SYS and CONFIG.OLD
***** CONFIG.SYS
5:  LASTDRIVE=Z
6:  fcbs=1,0
7:  STACKS=9,256
8:  devicehigh=c:\dos\setver.exe
9:  DEVICE=C:\WINDOWS\HIMEM.SYS /v /m:1
10:  DEVICE=C:\WINDOWS\EMM386.EXE I=B000-B7FF I=C800-
EFFF NOEMS /v
11:  DEVICEHIGH=C:\DOS\ANSI.SYS
***** CONFIG.OLD
5:  LASTDRIVE=Z
6:  FCBS=1,0
7:  stacks=0,0
8:  device=c:\dos\setver.exe
9:  DEVICE=C:\DOS\HIMEM.SYS /v
10:  DEVICE=C:\DOS\EMM386.EXE I=B000-B7FF I=C800-EFFF
NOEMS /v
11:  DEVICEHIGH=C:\DOS\ANSI.SYS
*****
```

Notice that the first and last lines of the two files have not changed. This is normal. The other lines are different. It is easy to log the differences to keep track of system file changes after each application installation.

If the files to be compared are not located in the same directory, you must place the directory name in front of the filename when entering the FC command, for example:

```
FC /L/N  C:\DOS\CONFIG.SYS  C:\CONFIG.SYS
```

When comparing longer files, add the | MORE parameter at the end of the FC command line so the screen will display one screen of data at a time. For example, to compare old and new WIN.INI files, change to the Windows directory and type:

```
FC /L/N WIN.INI WIN.OLD | MORE
```

For more information about the File Compare command, enter **FC HELP** at the DOS prompt.

The DOS Difference

Game-running performance and the ability to do quick troubleshooting depend greatly on the MS-DOS version installed on your system. This chapter will explain some of the basic capabilities and differences in the many versions of the Microsoft (MS) disk operating system (DOS). It will clarify the differences between the three latest versions of MS-DOS: 6.2, 6.21, and 6.22.

The crucial DOS files that must be located in the root directory (C:\) of the hard disk are: IO.SYS, MSDOS.SYS, and COMMAND.COM. If the computer is running the DOS 6 Doublespace program, the DBLSPACE.BIN and DBLSPACE.INI files must be there too.

IO.SYS and MSDOS.SYS are hidden files, so you won't see them if you type **DIR** to perform a directory listing. To see all files listed, including hidden files, type **DIR,** instead. The comma is an undocumented function that displays hidden files. To view long file listings, type **DIR, /P**. The comma displays hidden files and the /P switch will pause the screen display for easy viewing.

The IO.SYS file is interface software that works with the PC hardware and BIOS ROM (basic input/output system read-only memory) circuitry. It ensures that the machine is in good working order. It checks base memory and ports (the mouse, serial, keyboard, and other ports) for proper operation.

The MSDOS.SYS file is the disk operating system software. It allows programs to have access to all of the ports and it manages memory and disk functions on the PC.

The COMMAND.COM file sets up and implements the user interface. It generates the C:\ prompt, executes program instructions, and accepts typed commands by the user from the command line.

The above files are needed by all PC-compatible computers. Their capabilities will vary depending on the MS-DOS version. The other files that are included with MS-DOS will also vary depending on the version.

There are other commercial versions of "DOS" on the market for PC compatibles. They will work and operate your PC like MS-DOS. Alternate DOS types include PC-DOS and Novell DOS (also known as DR.DOS). This book is based on using the utilities and files included with MS-DOS 6.2 or above. If you are using another commercial version of DOS, you should refer to the manufacturer's manual for the proper commands, syntax, and utilities to duplicate the tips and suggestions in this book.

Some IBM-compatibles come with a special original equipment manufacturer's (OEM) version of DOS. Before upgrading an OEM DOS version to DOS 6.2, check with the manufacturer and with Microsoft about any known conflicts or incompatibilities.

In the following section, I'll describe the major functions and utility programs included with each new MS-DOS version. Each upgrade could do everything the previous version could do and then some; thus each listing here describes only the new additions to that version;

To see more command options, enter **HELP** at the DOS prompt. You can also check for a README.TXT document file in the DOS directory or on one of the DOS diskettes for more information.

DOS Versions

MS-DOS Version 1.0
This is the original IBM PC operating system, which supported only 160-kilobyte (K) floppy disk drives.

MS-DOS Version 1.1
The next revision allowed for 320K floppy disk drives. A file's last time saved was displayed on a directory listing.

MS-DOS Version 2.0
This DOS version could support a 10-megabyte (MB) hard disk drive. 180K and 360K floppy disks were recognized, along with a file and directory tree format.

MS-DOS Version 2.1
Half-height floppy disk drives could now be recognized.

MS-DOS Version 3.0
High-density 5-1/4-inch disk drives and 20 MB hard drives are now recognized.

MS-DOS Version 3.1
Local area networks (LANs) are now supported

MS-DOS Version 3.2
This version supported 3-1/2-inch 720K floppy disk drives. The new XCOPY command allowed faster copying routines.

MS-DOS Version 3.3
A few more commands were added (e.g., FASTOPEN and NLSFUNC).

MS-DOS Version 4.0
Hard drive DOS partitions could now be larger than 32 MB. The DOSSHELL program was introduced in this version. Device drivers for expanded memory (EMS) were included for the first time.

MS-DOS Version 4.01
This was a minor bug-fix version. It is essentially the same as DOS version 4.0.

MS-DOS Version 5.0

MS-DOS 5.0 support the use of upper memory blocks (UMB). The UMB area and device drivers can be used to load commands, device drivers, and TSRs.

Device drivers and TSRs can be loaded into upper memory via the DEVICEHIGH and LOADHIGH commands. In previous versions of MS-DOS, these programs loaded into base memory, decreasing the amount of base memory available for other applications.

MS-DOS 5.0 uses less base memory in XT class machines and significantly less base memory in AT-class and higher machines, with at least 64K of extended memory.

The new MIRROR command is used in conjunction with the UNFORMAT and UNDELETE commands to recover deleted files.

The new UNFORMAT command is used to restore a hard drive that has been accidentally formatted.

The new UNDELETE utility is used to recover files deleted by the MS-DOS DELETE command.

The MS-DOS 5.0 FORMAT command has an additional option for quickly formatting a drive or diskette. This formatting option requires 80 percent less time to reformat a drive or diskette.

Microsoft Quick Basic Interpreter (QBI) version 1.0 was included with MS-DOS 5.0. QBI features an improved editor and complete, integrated online help.

A new word-processing program called EDIT is included, as well as the old EDLIN text file editor. EDIT has the same improved menu and mouse features as the QBI.

A new program named DOSKEY is included with MS-DOS 5.0. This program is used for recalling previous MS-DOS commands typed in at the MS-DOS prompt. DOSKEY can also be used as a macro program.

The MS-DOS 5.0 MEM command now has a new listing type, called *classify*, showing memory usage in an easily-read format.

MS-DOS 5.0 supports greater than 32 MB partitions without the need to load the SHARE.EXE program.

The SETVER program included with MS-DOS 5.0 can report back a chosen MS-DOS version to programs that require an older MS-DOS version to run. Once the SETVER program is loaded, it will automatically check each program to determine if an older MS-DOS version is required.

MS-DOS version 6.0

DOS 6.0 is an enhanced operating system which includes many new attributes that users have become familiar with in third-party software. DOS 6.0 has been improved in many of its standard features, as well as a few minor additions to its list of internal commands.

Aside from the new features, DOS 6 is basically the same operating system as DOS 5.0, without the major operating system changes present in the DOS 4.01 to DOS 5.0 upgrade.

New features and enhancements with version 6.0 included the following:

- **ANTI-VIRUS** DOS 6.0 introduced Microsoft ANTI-VIRUS, a menu-driven program that can identify and remove more than 800 different viruses.
- **DEFRAG** Microsoft DEFRAG is a de fragmentation utility used for optimizing disk space.
- **DELTREE** The DELTREE command deletes a directory with all sub directories and files located within, regardless of file attributes.
- **DEVICEHIGH** Both DEVICEHIGH and LOADHIGH have been improved to enable the user to specify a memory region into which to load a program or device driver.
- **DIR** The /C switch for the DIR command will display file compression ratios on compressed Doublespace drives.
- **DOUBLESPACE** Microsoft Doublespace is an integrated disk-compression utility (similar to Stacker, DoubleDisk, Superstor, etc.) that increases available disk space. Doublespace requires no device drivers in order to read or write to a compressed disk.
- **EMM386** EMM386.EXE has been improved to access more upper memory blocks, and is able to allocate EMS and XMS memory from a dynamic memory pool (making it unnecessary to specify EMS needs at bootup).
- **HELP** The Help features of DOS have been modified to include a hypertext Help file. For users that prefer the traditional Help format, FASTHELP display a screen similar to DOS 5.0's Help.

- **INTERLINK** INTERLINK is a program that enables the user to transfer files and share drives with another computer via either serial or parallel connection.
- **LOADHIGH** Both DEVICEHIGH and LOADHIGH have been improved to enable the user to specify a memory region into which to load a program or device driver.
- **MEM** The MEM command has been enhanced to provide more information about the memory in use and the programs that are resident.
- **MEMMAKER** MEMMAKER is a program used to maximize available memory by optimizing the CONFIG.SYS and AUTOEXEC.BAT files.
- **MOVE** The MOVE command moves one or more files to a specified location. MOVE can also be used to rename directories.
- **MSD** DOS 6.0 includes Microsoft Diagnostics (MSD) 2.1, a program that gathers and displays technical information about the computer.
- **MULTI-CONFIG.SYS** DOS 6.0 CONFIG.SYS files can be menu-driven, allowing multiple configuration choices in a format similar to structured batch language.
- **NUMLOCK** DOS 6.0 includes an environment variable called NUMLOCK, which, when included in the CONFIG.SYS file (e.g. NUMLOCK=OFF), specifies the status of the NUMLOCK key.
- **POWER MANAGER** The POWER program conserves up to 25 percent of battery power on laptop computers that conform to the advanced power management (APM) specification. If the laptop does not conform to APM, the power savings will be about 5 percent.
- **UNDELETE** The UNDELETE command has been enhanced to allow three levels of protection against accidentally deleting files (there were only two in DOS 5.0). The new file protection option, called SENTRY, copies deleted files to a hidden directory.
- **Startup Command Bypass** Holding the Shift key or pressing F5 will completely bypass both the AUTOEXEC.BAT and CONFIG.SYS files, setting the path to C:\DOS and the

prompt to pg. Pressing F8 will cause CONFIG.SYS to ask to load each device driver, then prompt the user to answer whether AUTOEXEC.BAT should be processed.

- **Startup Messages (Enhanced Feature)** Fewer technical status messages are displayed while CONFIG.SYS is processed. When standard device drivers are loaded, the only message usually displayed is **Starting MS-DOS**.
- **Windows Applications (New Feature)** DOS 6.0 includes three new Windows applications: Microsoft Backup, Undelete, and Microsoft Anti-Virus.

Crucial DOS 6.0 File Size and Version

File	Size (in Bytes)	Version
HIMEM.SYS	14208	3.10
EMM386.EXE	115294	4.48
SMARTDRV.EXE	42073	5.00
MSCDEX.EXE	25377	
COMMAND.COM	52925	
IO.SYS	40470	
MSDOS.SYS	38138	

MS-DOS Version 6.2

The MS-DOS 6.2 upgrade added new and improved features that deliver performance and ease-of-use enhancements. The new features and enhancements included the following:

- **SCANDISK** ScanDisk is a new utility that detects and repairs errors on both uncompressed and Doublespace drives. It repairs simple system errors such as lost allocation units and physical disk errors. Before compressing the drive, Doublespace automatically launches ScanDisk.
- **DOUBLEGUARD** This is Doublespace's new safety feature, which protects against data corruption. DoubleGuard verifies the integrity of memory used by Doublespace. If DoubleGuard detects data corruption, it shuts the system down to minimize the damage to data.

- **HIMEM** HIMEM automatically tests the system's memory when the computer is started. This test identifies unreliable memory chips.
- **SmartDrive** SmartDrive now defaults to a read-only cache. SmartDrive will also cache CD-ROM drives.
- **CONFIRMATION** MOVE, COPY, and XCOPY now ask for confirmation before copying a file over another file with the same name.
- **DOUBLESPACE** Doublespace drives can easily be uncompressed. Doublespace also automatically mounts compressed floppy disks and other removable media, even when Windows is running. The settings for DBLSPACE.INI, the Doublespace initialization file, can now be altered at the DOS prompt without using the ATTRIB command and a word-processing program.
- **AUTOEXEC.BAT** DOS 6.2 now allows for a line-by-line execution of AUTOEXEC.BAT when F8 is pressed.
- **FILE SIZES** The output display of the DIR, MEM, CHKDSK, and FORMAT commands is now easy to read, since it now uses commas for numbers exceeding three digits. For example, instead of a message such as **1000000 bytes free**, it now reads **1,000,000 bytes free.**
- **DISKCOPY** By using the hard drive as a temporary storage area, Diskcopy can duplicate diskettes in a single pass.

Crucial DOS 6.2 File Size and Version

File	Size	Version
HIMEM.SYS	29136	3.10
EMM386.EXE	120926	4.48
SMARTDRV.EXE	45145	5.00
MSCDEX.EXE	25361	
COMMAND.COM	54619	
IO.SYS	40566	
MSDOS.SYS	38138	

MS-DOS Version 6.21

This DOS version is essentially the same as DOS 6.2, with two exceptions concerning Doublespace. That compression utility is no longer included for users that purchased the complete program version or received it loaded on a new PC. Users that owned DOS 6.0 and used the DOS 6.21 upgrade can continue to use Doublespace. This change resulted from a lawsuit with STAC Electronics over the programming code used in Doublespace.

Also, the Microsoft Backup and Microsoft Backup for Windows programs could no longer create or read compressed backup files. If the user had DOS 6.0 or 6.2 already installed, the setup program allowed users to add this function. If the upgrade was done on a previous DOS version, the capabilities were not included with the new DOS version.

Crucial DOS 6.21 File Size and Version

File	Size	Version
HIMEM.SYS	29136	3.10
EMM386.EXE	120926	4.48
SMARTDRV.EXE	45145	5.00
MSCDEX.EXE	25361	
COMMAND.COM	54619	
IO.SYS	40566	
MSDOS.SYS	38138	

MS-DOS Version 6.22

MS-DOS 6.22 is an upgrade to MS-DOS 6.0. All of the new features, utilities, and commands are virtually identical to those in DOS 6.2 A new compression engine called Drivespace is now included in MS-DOS 6.22. All of the Doublespace commands are included with Drivespace. A user can substitute any Doublespace command and insert the Drivespace equivalent. For example, the command DBLSPACE/LIST would become DRVSPACE/LIST. ScanDisk is updated to support new Drivespace volumes. Microsoft Backup for DOS and Backup for Windows have been upgraded to include the new MRCI 2 (Microsoft Real-time Compression Interface 2) format.

Crucial DOS 6.22 File Size and Version

File	Size	Version
HIMEM.SYS	29136	3.10
EMM386.EXE	120926	4.49
SMARTDRV.EXE	45145	5.01
MSCDEX.EXE	25361	
COMMAND.COM	52925	
IO.SYS	40470	
MSDOS.SYS	38138	

New Features Upgraded from MS-DOS 6.0

- **ScanDisk** ScanDisk is a utility that detects, diagnoses, and repairs disk errors on uncompressed and Drivespace-compressed drives. Enter **HELP SCANDISK** at the DOS prompt for more information.
- **Enhanced Select Boot** MS-DOS 6.22 allows you to skip or execute individual commands in the AUTOEXEC.BAT file. Enter **HELP CONFIG.SYS** for more information.
- **Enhanced Clean Boot** Drivespace may be bypassed when booting. Enter **HELP CONFIG.SYS** for more information.
- **SmartDrive** now loads as a read-only cache by default. When write cache is enabled, the DOS command prompt is not displayed until SmartDrive has written to the disk. SmartDrive also supports caching of CD-ROM drives.
- **Microsoft Defragmenter** has been improved to handle about 20,000 files.
- **MOVE, COPY, and XCOPY Commands** now ask for confirmation before copying over a file with the same name.
- **DISKCOPY** can now use the hard drive as temporary storage space, speeding up the disk-to-disk copying process.
- **Improved Boot Capabilities** This DOS version can boot a PC with a previous DOS 6 version of Doublespace or Drivespace, or even PC-DOS' SuperStor/DS.

Basic Troubleshooting Tips

- Be sure you're running the correct MS-DOS version for your PC. IBM-compatible PCs from Compaq, IBM, Tandy, and other makers require a special OEM version of DOS to run properly. To check which version of DOS you're running, type **VER** Enter at the DOS prompt. The command **VER/R** will display the MS-DOS version, the revision number, and its location in memory.
- Check the speed at which the PC is running. If you have a Turbo button, make sure that it is set on Turbo (high-speed) mode. To test which mode you are currently in, go to the DOS prompt and type **DIR**. Notice how fast the file listing goes by. Then change the speed of the PC by pushing the Turbo button or with the appropriate key combination (e.g. Ctrl+Alt+−), which you can find in the PC owner's manual. Enter **DIR** again and notice the difference in speed. The faster directory listing mode was the Turbo mode; the PC should always run at this speed. The only exception is when you are playing older DOS game programs that run too fast in the Turbo mode.
- If a DOS game doesn't load or install and shows the message **Incorrect DOS version**, you can use the SETVER command to alleviate the problem. The SETVER command can be used in the CONFIG.SYS file with a line like DEVICE=C:\DOS\SETVER.EXE. To make the game program load with a newer DOS version (when it needs an older version), use the following command at the DOS prompt before you type the command that starts the game: **SETVER GAME.EXE 3.30**. Substitute the filename that starts your particular game for GAME.EXE. Similarly, replace the DOS version number with the number that your game prefers. Check the game manual or requirements sticker on the box to find out the DOS version it was written for.
- To verify the version of MS-DOS that is loaded on your computer, at the DOS prompt type **VER**. To verify the DOS version, revision number, and location in memory, type **VER /R.**

Checking Your Hardware Setup

Many post-game installation problems are the result of altered settings in your PC. It is crucial for you to have a copy of the original setup configuration information for the following:

- PC CMOS setup screen
- Sound card
- CD-ROM drive configuration
- Video card
- Windows setup utility
- Any other hardware accessories installed on your computer

CMOS Setup

The PC setup information controls all of the hardware on your system, including the disk drives, monitor, mouse, and other port devices. To get to your setup screen, at the DOS prompt you have to press a certain key combination, such as Ctrl+Alt+S or Ctrl+Alt+- or Ctrl+Alt+Esc. On some systems you must press F1 or F2 before you hear the beeping sound your computer emits to signal normal operation. Check your computer's manual for directions on how to get to the CMOS setup screen.

This is a typical PC CMOS setup screen:

```
System Time: 10:58:37    Numlock on at boot:    YES
System Date:  Mon Jan 14, 1996
Diskette A: 3.5", 1.44 MB
Diskette B: 5.25", 1.2 MB  Cyl  Hd Pre  LZ  Sec  Size
Hard Disk 1: Type 49       1001 15  0   0    17   124
Hard Disk 2:  Not Installed
Base Memory:  640KB
Extended Memory:  7168KB
Monitor Type:  Color Interlace
Video Card:    VGA/EGA
Keyboard:     Installed
CPU Speed:     Fast
Cache:   Enabled
Processor Type:   80486
Coprocessor Type:80387 or compatible Option ROMs Found
Reserved Memory:   Unknown    Segment    Size
BIOS Version #:     1.01       C000       32K
Video Mode:         03h
Serial Ports:       03F8h 02F8h
Printer Ports:      0378h
```

Sound Card Setup

The sound card's setup utility program controls its hardware options (the IRQ, DMA channel, and I/O address) and other functions. If the sound card is connected to a CD-ROM drive, the setup program controls the CD-ROM port and will set up the proper software drivers and add lines in the CONFIG.SYS and AUTOEXEC.BAT files to initialize it. A typical sound card setup utility menu is shown below.

```
HARDWARE CONFIGURATION
SOUND                                   MICROSOFT WINDOWS
BLASTER                                      SOUND SYSTEM

MPU401                                              CD-ROM
(MIDI)                                              DRIVE
DEFAULT                                             QUIT
SETTING                                       CONFIGURATION

Microsoft Windows Sound System (MWSS)
Sound Blaster
Description                          Current Setting
Port Address                               220H
Interrupt                                  IRQ5
Game Port                                Enabled
Use MWSS                                   YES
Port Address                               530H

MPU401 (MIDI)
Description                          Current Setting
MPU401 Enabled                             YES
Port Address                               330H
Interrupt                                  IRQ2

CD-ROM Module
Description                          Current Setting
CD-ROM Model                     Panasonic CR563
```

CD-ROM Setup

The CD-ROM setup or utility program controls its hardware functions, IRQ, DMA channel, and I/O address. The program will also rewrite the CONFIG.SYS and AUTOEXEC.BAT files to initialize it. This is a sample CD-ROM setup utility screen:

```
**************************************
*****     MSCDEX SETUP PROGRAM     *****
**************************************
This setup program will copy the Microsoft MS-DOS CD-
ROM Extensions and selected CD-ROM drivers from the
installation disk to your system disk. The setup
program will help determine configuration settings
for your AUTOEXEC.BAT and CONFIG.SYS files and it can
make the necessary changes to these files for you so
the Extensions will be loaded the next time your
system is rebooted. You will also have the choice of
saving the new settings in AUTOEXEC.NEW and
CONFIG.NEW and leave your original AUTOEXEC.BAT and
CONFIG.SYS files unmodified.

The following CD-ROM device drivers were found:
MMCD.SYS    size  62974 bytes.....DMA Transfer
MMCDS.SYS    size  64120 bytes.....NON DMA Transfer

Which of the following device drivers do you want to install?
Do you want to install   MMCD.SYS? [Y or N] Y

If you are installing onto a bootable floppy disk,
put your normal boot disk in drive A: and specify
drive A: as the drive to copy files onto.
If you are installing onto your hard disk, specify
drive C: as the drive to copy files onto.

Press [ENTER] when ready to proceed.

Which directory would you like the CD-ROM device
driver files installed in?
(Press ENTER for default)
C:\CDROM          [default]

Installing file MTMCDD.SYS
Copying file MTMCDD.SYS to C:\CDROM\MTMCDD.SYS...  ...Done

Press [ENTER] when ready to proceed.

Which directory would you like MSCDEX.EXE installed
in?
(Press ENTER for default)
C:\BIN          [default]

Installing file MSCDEX.EXE
Copying file MSCDEX.EXE to C:\BIN\MSCDEX.EXE...  ...Done
```

```
Press [ENTER] when ready to proceed.

The setup program has copied MSCDEX and the CD-ROM
device drivers to your system disk. If you continue,
setup will copy your CONFIG.SYS and AUTOEXEC.BAT
files to CONFIG.NEW and AUTOEXEC.NEW and make the
changes to these copies. When the changes are com-
plete, you will have the choice of:
Leaving CONFIG.SYS and AUTOEXEC.BAT alone and copying
the changes yourself from the .NEW files.
or
Letting setup make the changes to your CONFIG.SYS and
AUTOEXEC.BAT for you.

Would you like to continue the setup procedure? [Y or N] Y

**************************************
*****     UPDATING CONFIG.SYS      *****
**************************************

Select memory buffer size ? (MIN=2,MAX=21)
 (Press ENTER for default)
/M:2          [default]
/M:

MTMCDD.SYS is device driver for DMA transfer.
You need to specify the DRQ and IRQ ch number of the I/F card.

Which channel(1,3) would you like DRQ ch specified?
 (Press ENTER for default)
/T:3          [default]
/T:

Which channel(1,3) would you like DRQ ch specified?
 (Press ENTER for default)
/T:3          [default]
/T:

Which channel(2,3,5) would you like IRQ ch specified?
 (Press ENTER for default)
/I:3          [default]
/I:

Adding the following entries to C:\CONFIG.SYS
DEVICE=\CDROM\MTMCDD.SYS /D:MSCD001 /T:3 /I:3 /S:1 /M:2

Press [ENTER] when ready to proceed.
```

(continues)

```
CONFIG.NEW now contains the contents of your CONFIG.SYS
file and the setup program changes. You have the choice
of leaving the changes in CONFIG.NEW without modifying
your CONFIG.SYS and make the changes yourself, or setup
can make the changes for you.

Do you want setup to make the changes to CONFIG.SYS? [Y or N]
Press [ENTER] when ready to proceed.
****************************************
*****    UPDATING AUTOEXEC.BAT    *****
****************************************
Adding the following entry to 'C:\AUTOEXEC.BAT':
\BIN\MSCDEX.EXE /D:MSCD001
Press [ENTER] when ready to proceed.

Do you want setup to make the changes to AUTOEXEC.BAT? [Y or N]

****************************************
*****       SETUP COMPLETED        *****
****************************************
```

Both the CD-ROM device driver and MSCDEX require small amounts of additional memory to run, which should not normally cause any problems. But if you find after you have installed MSCDEX that some programs no longer run because there is not enough memory, you may want to review your CONFIG.SYS and AUTOEXEC.BAT files. Look for entries that consume memory—such as GRAPHICS or FASTOPEN—and if you don't need them, you can remove those lines.

Even after you run this setup program, installation may not be complete, because you requested setup to leave either CONFIG.SYS or AUTOEXEC.BAT unmodified. To install MSCDEX completely, you will have to review the changes setup would have made to these files in CONFIG.NEW or AUTOEXEC.NEW and make the necessary changes to your system files.

Video Card Setup

Some video cards have setup or configuration software utilities that control display mode operation. This is a sample screen control setup utility:

```
                    FlexDesk Control Panel
                     File  Features Help
  Screen                                          Colors    OK
  640x480                                         16 colors
  800x600                                         256 colorsCancel
  1024x768                                        65K colors
  1280x1024                                       16.7M colors
```

Windows Setup

If you have Windows installed, you can change to the Windows directory and type **SETUP** at the DOS prompt. This will start the setup program utility, which displays the operating system type, video display mode, and more vital information that you should record. See Part 8: Windows Troubleshooting, for more details.

Setup for Other Installed Hardware

Review and log all of the settings of any other hardware accessory utility programs that are installed on your PC. Although you may let them install themselves automatically, it is important to know what the standard default settings should be. Hardware setup programs may be part of the software included with your scanner, joystick, or fax/modem.

Master Troubleshooting Checklists

Basic Troubleshooting

- With DOS 6.2, by simply holding down the F8 key at startup time you can bypass any line you want. The PC will start up normally the next time with no intervention needed. This makes creating game "boot disks" obsolete.
- If you have the DOS 6 (and higher) Doublespace or Drivespace compression program installed, you can completely bypass running the compression utility for a session by holding down the Ctrl+F8 keys at startup time. This method can help you load some games when the conventional memory is too low. Plus, there is an Uncompress utility included so you can uncompress the hard disk in one step (this isn't available with DOS 6.0).
- Most game users have to have different files loaded in the CONFIG.SYS and AUTOEXEC.BAT files at startup time for different games. DOS 6.2 allows you to make a simple MultiConfig menu file to handle this. You can create a startup menu that prompts you to select which startup configuration you'd prefer on that particular session. Every user can easily hit a key for their desired applications without needing to know any technical parameters. For more information, type **HELP MULTI-CONFIG** at the DOS prompt.
- Many problems can be alleviated just by obtaining and installing updated device drivers! Contact the manufacturers of all of your hardware accessories via letter, phone or a bulletin board service (BBS). Check the reference section at the end of this book for a list of companies and their phone numbers. Check with the makers of your accessories at least

twice a year for updates and ask about known conflicts and problems with certain programs and other hardware.

- To see all files listed, including hidden files, enter **DIR,** at the DOS prompt. The comma is an undocumented function that displays hidden files. To view long file listings, enter **DIR, /P**. The comma displays hidden files and the /P switch will pause the screen display for easy viewing.
- Be sure you're running the correct MS-DOS version for your PC. IBM-compatible PCs from Compaq, Tandy, and other companies require a special OEM (original equipment manufacturer) version of DOS to run properly. To check which version of DOS you're running, type **VER** at the DOS prompt. Entering the command **VER/R** will display the MS-DOS version, the revision number, and its location in memory.
- Check the speed at which the PC is running. If you have a Turbo button, make sure that it is set to Turbo (high-speed) mode. To test which mode is faster, go to the DOS prompt and type **DIR**. Notice how fast the file listing goes by. Then change the speed of the PC. Push in the Turbo button or use a multiple key combination (e.g., Ctrl+Alt+-; check your PC owner's manual to be sure). Type **DIR** again and notice the difference in speed. The faster directory listing mode was the Turbo mode, and the PC should always run at this speed. The only exception is when you are using older DOS game programs, which run too fast in the Turbo mode.
- If a DOS game doesn't load or install and shows the message **Incorrect DOS version**, you can use the SETVER command to alleviate the problem. The SETVER command can be used in the CONFIG.SYS file with a line like this: DEVICE=C:\DOS\SETVER.EXE. To make the game program load with a newer DOS version (when it needs an older version), use the following command at the DOS prompt before you type the command that starts the game: SETVER GAME.EXE 3.30. Substitute the GAME.EXE name for the filename that starts your particular game. Similarly, substitute the DOS version number for the number that your game prefers. Check the game manual or requirements sticker on the box to find out which DOS version it was written for.

- If you need to make minor changes to the CONFIG.SYS file, you can use the following method to get individual line prompting at bootup time. For example, if you need to bypass just one or two lines to gain more conventional memory free, you can add one character, a question mark (?), to the filename and you'll be prompted automatically to load or bypass the file(s). This method eliminates the process of waiting until you see the **Starting MS-DOS** message, holding down the F8 key, and processing every line in the CONFIG.SYS and AUTOEXEC.BAT files. To have MS-DOS automatically prompt you to load a line, just add a question mark after the word DEVICE, for example: DEVICE?=C:\WINDOWS\MOUSE.SYS.

- When you have lost or inadvertently rewritten your system files, you can use the DIR and REN commands to find usable older versions to recover from a mishap. The directory command is most widely used to view the contents of a directory. But it can also be put to use as a file locator with its /S parameter. For example, to locate all of the CONFIG files on the entire hard disk, type **CD**. This will put you in the root directory. Then, at the DOS prompt, enter **DIR CONFIG.* /S**. DOS will search for any CONFIG file on the entire hard disk; the /S parameter instructs DOS to search every subdirectory. The asterisk (*) is a wildcard character, which means that DOS should search for all files with any character where the asterisk is shown.

- The REN DOS command can easily rename files. To do this, you must type the rename command (REN), the filename as it is now, a space and then the name that you want to rename the file to. For instance, to rename the CONFIG.OLD file CONFIG.SYS, change to the directory that the file is in and type **REN CONFIG.OLD CONFIG.SYS**. Then copy the file to the directory where you want it. To copy the CONFIG.SYS file to the root directory, for example, type **COPY CONFIG.SYS C:**.

- To undelete a file with the standard Undelete program, at the DOS prompt, type **UNDELETE C:\PATH*filename***. You simply fill in the directory name in the PATH section of the line and add the appropriate filename. If you don't know the filename, or if there is a large group of files you want to

recover from a directory, use *.* in its place. Asterisk, period, asterisk is a wildcard for DOS that means to use all files with any three-letter extension. You can be specific about the filename or the extension or even a single letter and use the asterisk to help find the rest of a file's name.

- If you save data in an application program or game, the Smartdrive cache program captures the data and holds it temporarily in memory. To ensure that any unwritten data is written to disk, enter **SMARTDRV /C** at the DOS prompt. To flush the entire Smartdrive cache, both write data and read data, type **SMARTDRV /R** at the DOS prompt.

Memory Problems

- You can manually load programs into the upper memory area by editing their line statements in the CONFIG.SYS and AUTOEXEC.BAT files. For program statements in the CONFIG.SYS file that begin with DEVICE, simply make it read DEVICEHIGH. For example, the line DEVICE=C:\WINDOWS\MOUSE.SYS would be changed to read DEVICEHIGH=C:\WINDOWS\MOUSE.SYS. For programs that are in the AUTOEXEC.BAT file, simply add the LOADHIGH command (or LH) at the beginning of the line. For example, the line C:\WINDOWS\MOUSE would be changed to read LH C:\WINDOWS\MOUSE.
- To see how your PC is loading your programs, device drivers, and games in memory, type **MEM/C/P** at the DOS prompt. A listing of all loaded programs in conventional and upper memory will display. You'll also see how much space is available in both memory areas.
- Reduce the FILES statement in CONFIG.SYS to 30 or lower. Experiment with the number until you get an error message and then increase the amount accordingly. By default, DOS assigns 8 file handles. Every file handle over 8 will cause DOS to reserve 39 bytes for each one.
- If you are using the Smartdrive disk cache, reduce the BUFFERS statement in CONFIG.SYS to 10. Each buffer number causes DOS to reserve 532 bytes.

- If you do not have a STACKS command, add one. By default, DOS will reserve 2K of memory for stacks. Make the STACKS statement in the CONFIG.SYS file STACKS=0,0. If you get a "stacks overflow" message or if any lockups occur, rewrite the line to read STACKS=9,256.
- To see how your PC is configuring its available memory and how it is loading programs in conventional and upper memory, type **MEM/C** at the DOS prompt. A listing of all loaded programs in conventional and upper memory will display. You'll also see how much memory is available as extended memory (XMS) and expanded memory (EMS).
- Check the LASTDRIVE line in CONFIG.SYS and make sure it reads the last drive in your system. For example, if you only have an A and a C drive, the line should be LASTDRIVE=C. Each additional drive beyond the actual drives installed takes away 88 bytes of conventional memory free.
- Eliminate unnecessary files from loading in the CONFIG.SYS and AUTOEXEC.BAT files like POWER.EXE, SETVER, and DOSKEY. If you are not using Doublespace, eliminate the DBLSPACE.BIN from the root directory (C:\).
- If you do not have a line in the CONFIG.SYS file that reads FCBS=1, add one. This can increase your free conventional memory by a few bytes.
- You can gain a little more free memory by lowering the sector buffers reserved for your CD-ROM cache. At the end of the MSCDEX file line in the AUTOEXEC.BAT file, you'll usually have an M:*xx* designator. You can make this number as low as 2 or as high as 62. Each number reserves 2K of memory. After you change the number, check the free memory available with the MEM/C/P command.
- To quickly see the locations and size of free areas of conventional and upper memory, type **MEM/F** at the DOS prompt.
- If after running the Doublespace utility your available conventional memory is reduce by about 50K, you can load the Doublespace program (DBLSPACE.BIN) into the upper memory area by adding the following line to the CONFIG.SYS file: DEVICE=C:\DOS\DBLSPACE.SYS /

MOVE. After adding the line, saving the file and rebooting, check the available memory again by typing **MEM/C** at the DOS prompt. If there is no difference, try placing the line in different locations in the CONFIG.SYS file.

- If you are running the DOS 6.2 Doublespace compression program, you can add this line to the CONFIG.SYS file to gain 5K of conventional memory: DBLSPACE / AUTOMOUNT=0. (You will have to manually mount compressed floppy disks with the DBLSPACE /MOUNT A: command if you make this change.)
- Placing all of the SET environment variables near the end of the AUTOEXEC.BAT file will save memory. Remember, the PATH and TEMP commands are environment variables.
- If a game displays a message "insufficient DPMI memory" after loading, you must supply expanded memory by adding RAM to the end of the EMM386.EXE statement. If you are already supplying expanded memory, bypass using Smartdrive from the AUTOEXEC.BAT file to give it the maximum amount of EMS (expanded memory) available.
- If a game blacks out, locks up or acts mysteriously, supply EMS (expanded memory) to the PC and try running it again.
- *For advanced users:* To gain more memory when using the RAM statement in the EMM386 line in CONFIG.SYS, use the Microsoft Diagnostics (MSD) utility to find other unused upper memory blocks. Type **MSD** at the DOS prompt to launch MSD. If you find a 64K or larger upper memory area, you can make the EMM386 driver use this area to provide expanded memory by writing down the starting address of the free memory area. For example, if address EOOOO to EFFFF is unused, add FRAME=EOOO to the end of the EMM386 line (e.g., DEVICE=C:\DOS\EMM386.EXE RAM FRAME=EOOO). You only need the first four digits of the starting address of the memory area.
- Conventional memory may also be freed by including the monochrome range (B000-B7FF) on the EMM386.EXE line in CONFIG.SYS. (This range of memory may already be included.) Here's an example:

```
DEVICE=C:\DOS\EMM386.EXE RAM NOEMS I=B000-B7FF
```

- MOUSE.COM can be loaded from the DOS prompt or from the AUTOEXEC.BAT file. It can also be removed from memory by typing **Mouse OFF** at the DOS prompt.
- If your CONFIG.SYS file has the EMM386.EXE driver with the RAM designation, you can load the MSCDEX sector buffers into the expanded memory area. This can be done by adding /E at the end of the device driver line. With this configuration, you can free up more conventional or upper memory space, depending on how the MSCDEX driver is presently loaded. For example, if the MSCDEX driver is loaded high with the LH designation in the AUTOEXEC.BAT file, the driver will be loaded into the upper memory area. Depending on how many sector buffers are loaded with the M:*xx* designation, the file will occupy from 16K to over 128K (kilobytes) of upper memory. When you place the /E designation at the end of the line, only 16K of upper memory will be used to load the MSCDEX driver. The sector buffers will load into expanded memory. Since DOS 6 provides extended memory to be used as expanded memory, the sector buffers are actually being loaded into extended memory—the memory area above 1 MB. The following line will load the CD-ROM sectors into extended memory, thus freeing up upper and conventional memory: LH C:\DOS\MSCDEX.EXE /D:MSCD0001 /M:30 /E.
- If the CD-ROM cannot be accessed from Windows and if doing a DIR command at the DOS prompt gives the error message **EMM no longer valid, CDR 102**, check the MSCDEX.EXE file line in the AUTOEXEC.BAT file. If the line has a /E in it, remove the /E off the end of the line, save the file and reboot the computer. Loading the MSCDEX into conventional memory will also solve this problem.
- Your first option is to have MemMaker undo the changes automatically. If you want to quickly return to your pre-MemMaker configuration, at the DOS prompt type **MEMMAKER/UNDO**.
- When MemMaker configured your system, it created a log of the software drivers and programs to optimize from the information in your CONFIG.SYS and AUTOEXEC.BAT files. The log file is called MEMMAKER.STS. To view it, type **EDIT C:\DOS\MEMMAKER.STS.**

Some programs require virtually the same size memory area free when loading and after loading, while others need as little as 15 percent of the memory area they required to load.

Because you have a great guide to memory-loading size/installed size of your device drivers provided by the MEMMAKER.STS file, it's easy (for advanced memory jocks) to use the MEM/C/P command or the MSD program to view the PC's memory map and find more upper memory areas free. You can also (after backing up your original system files) change the order of some of the device driver and program lines in your system files to force certain programs to load before others do.

When altering the loading order of programs in the CONFIG.SYS and AUTOEXEC.BAT files for experimentation, keep these timesaving safety tips in mind.

- Of course, back up your original copies of the CONFIG.SYS and AUTOEXEC.BAT files
- The following lines should always appear *first* in the CONFIG.SYS file: HIMEM.SYS, EMM386, DOS=HIGH,UMB.
- If you have a DBLSPACE.SYS/MOVE line, it should be loaded before other drivers, because unless it has about 50K of memory space, it won't load high.
- If you have a CD-ROM drive and you are using the Smartdrive cache program in the AUTOEXEC.BAT file, place the MSCDEX.EXE line above the SMARTDRV.EXE line, or else the Smartdrive program will not cache the CD-ROM drive.
- If you are using the MultiConfig menu program, create a CONFIG.SYS file for each separate configuration. You have to rename the original CONFIG.SYS, combine the [Common] and [Menuitem] lines into a separate file, name the new file CONFIG.SYS, copy it to the root directory, and run MemMaker. Then create a MultiConfig file that is optimized with the information you learn by viewing the MEMMAKER.STS file.
- EMM386 exception errors usually occur after an upgrade version of MS-DOS is installed. The EMM386.EXE program line listed in the CONFIG.SYS file has probably been altered

from its pre-installation settings. Search the hard disk or older backup files for a previous version of the system's CONFIG.SYS file and edit it.

- Some games utilize their own memory manager and don't want you to run any other memory manager program, like EMM386.EXE. If you do, you may get a DPMI error. In this case, you must step through your CONFIG.SYS file (using the F8 selective bootup option) and skip over the EMM386.EXE file line. Then start the game again.

CD-ROM Problems

- Isolate the problem. Find out if it's the drive or the CD in the drive that is causing it. Is the disk upside down? If the CD must be placed in a caddy, try a different caddy. Clean the disc with a dry, soft cloth from the center to the edge before reinserting it into the drive. Test other CDs. Do they load okay? If so, it isn't a drive problem.
- If a Windows CD game won't get through the installation, change to the VGA video driver and reinstall it. Later, change back to the high-resolution driver to run the application. Before you install or load a CD-ROM game, make sure you have a CD in the drive first.
- If the CD-ROM drive behaves erratically, boot up the computer with a minimum configuration. Using the F8 step-through, just load the HIMEM.SYS driver, the CD-ROM driver, and the MSCDEX program. Check your system files and see if the drivers and MSCDEX are being loaded into upper memory; check to see if DEVICEHIGH or LH are at the beginning of those lines. If so, remove the HIGH and/or LH from the line, save the file(s), and reboot. If the problems cease, there may be a conflict in the upper memory area. You'll have to selectively boot up without certain files loading from the CONFIG.SYS and AUTOEXEC.BAT files to find the conflict by process of elimination. If there is a problem accessing the CD-ROM drive or programs in Windows, try starting Windows in Standard mode; at the DOS prompt, type **WIN/S**. Also, check the lines in your CONFIG.SYS and AUTOEXEC.BAT files for the proper syntax—proper spelling, colons (versus

semicolons), proper slash symbols, and spacing. Delete the CD-ROM and MSCDEX drivers from their directories and copy them from your backup disks into their respective directories.

- If your present version of MSCDEX is version 2.20 or lower, you may need to have the SETVER device driver loaded in the CONFIG.SYS file. Otherwise you may receive an "incorrect DOS version" message on the screen. This is a sample line for SETVER:

```
DEVICE =C:\DOS\SETVER.EXE
```

- Ensure that your PC is operating at its fastest speed (Turbo mode). Don't just go by whether the Turbo light is on (if your case has one). At the DOS prompt, type **DIR** and watch how fast the screen displays the file listing. Then change your PC speed (push the Turbo button or use your manual's recommended method for changing speed). Type **DIR** again and compare the speeds. Leave the PC in the fastest speed mode.
- If your CD-ROM drive is connected to your sound card, check the setup or configuration program in the sound card program directory. See the sound card manual for details. Make sure the configuration program is loading the CD-ROM device drivers.
- Some computer users have their PC cases standing on end. This can cause erratic operation in both the caddy and tray of internal CD-ROM drives. Keep the computer case upright for proper operation.
- If Windows displays the error message **Application has caused a general protection fault in module KRNL.EXE**, the Smartdrive CD-ROM caching module may have a conflict in memory. To alleviate this problem, you need to edit your CONFIG.SYS file by adding the /U parameter to the end of the line that has SMARTDRV.EXE and then restart your computer.
- If the CD ROM cannot be accessed from Windows and doing a DIR command at the DOS prompt gives the error message **EMM no longer valid, CDR 102**, check the MSCDEX.EXE file line in the AUTOEXEC.BAT file. If the line includes the parameter /E, remove it, save the file, and reboot the computer. Loading MSCDEX into conventional memory will also solve this problem.

CD-ROM Error Messages and Solutions

Device driver not found. No valid CD-ROM driver selected. The CD-ROM device driver failed to load or its device name (e.g., /D: MSCD001) doesn't match the name at the end of the MSCDEX program line. Check the system files for proper syntax. Enter **CHKDSK/F** at the DOS prompt to check for a corrupted file. You may have to delete and reinstall the CD-ROM and MSCDEX drivers and reboot.

Error in CONFIG.SYS (or AUTOEXEC.BAT) line* xx. *Driver not found. The CD-ROM driver or MSCDEX program for the CD-ROM drive were not found in the directory locations listed in the system files. Check the directories for the files and reinstall them if necessary.

Not enough drive letters available. If your PC has a network card or more than one hard disk installed, check for a LASTDRIVE line in the CONFIG.SYS file. By default, MS-DOS reserves five drive letters for your system. When MSCDEX is finally loaded from the AUTOEXEC.BAT file, all of the available drive letters may already be in use by your hard drive partitions, a network card or by a Stacker or Doublespace drive. To see how many drive letters you'll need, at the DOS prompt type drive letters from D on up until you get an error message (e.g., type **D:** and press Enter, then type **E:** and press Enter, and so on). Note the drive letter that results in an **incorrect drive specified** message. Use that drive letter designation in the CONFIG.SYS LASTDRIVE statement. Here's an example line: LASTDRIVE=J.

CDR101 not ready reading Drive D. This message indicates that the CD-ROM drive is having a problem reading data off of the disc (assuming one is in the drive). Check the obvious items: Ensure that a CD-ROM program disk is in the drive (not an *audio* compact disc); see if the drive light comes on when you do a DIR command on the drive; clean the disk, and check to make sure the CD caddy (if installed) is completely closed and free of foreign objects. See if the drive can read a different CD program disk. If so, switch the CD-ROM caddies.

CDR102: EMS memory no longer valid. A memory conflict between programs may have occurred in the upper memory area. Try rebooting the computer and recheck. Or do a minimal selective bootup until you find the conflicting driver program. If your CD-ROM drivers are loading high, load them into conventional memory. (Remove any HIGH or LH statements from the CD-ROM device driver line in the CONFIG.SYS—i.e., C:\CDROM.SYS\ROMS0001—and the MSCDEX line in the AUTOEXEC.BAT—i.e., C:\DOS\MSCDEX.EXE\MSCD0001).

CDR103: CD-ROM not High Sierra or ISO 9660. The CD may not be formatted for use with DOS or Windows. Check the format type with the manufacturer.

CDR104: CD-ROM door is open. Close the CD-ROM door or check the caddy (if installed) and see if it is fully closed.

Sound Problems

- If no sounds work in a game, test the sound card from its testing program utility, found in the sound card's subdirectory. Ensure that the IRQ, base address, and DMA channels are set properly. After saving the settings, turn off the PC and wait at least 5 minutes before rebooting. The sound card should be operating properly. If Windows is installed, test for sound in the Sound window of the Control Panel group. If you still don't hear sound or the sounds you hear don't sound right, reinstall the sound card's drivers from its installation utility disk.
- If you don't hear sounds in Windows, go to the Windows Main group and choose Control Panel. Double-click on the Sound icon. The dialog box that appears will have an Enable System Sounds check box at the bottom. Make sure there is a checkmark in it. To test for sounds, click on a Windows event (like Windows Start), click on a sound file (like DING.WAV), and then click on the Test button. You should here a sound from your speakers. If not, check your sound card's Mixer Control program from the sound card's Windows group (or icon). Make sure all of the sound levels are up and that the audio output is activated. See your sound

card manual for details about your particular program. If you still do not receive any sounds in Windows, reinstall the sound card drivers with the installation diskettes.

- When Windows makes a sound repeatedly, a game program probably altered the sound card settings in the BIOS ROM chips on the sound card or in the sound card's environment string. Sometimes the problem will disappear if you exit Windows and turn off the PC for at least five minutes. If it does, identify which game caused the problem and try a different configuration for sound, or contact the manufacturer's tech support department. If rebooting did not correct the problem, you'll have to check the sound card's drivers in the Windows Control Panel's Drivers window. Highlight your driver from the installed list and click on the Setup button. Check all of the standard settings—IRQ, base address, and DMA channel. If a setting has changed, input the proper information. (Good thing you have the settings written down!)
- When sounds will not play and you cannot find an environment line when you type **SET** at the DOS prompt, locate a previous version of your AUTOEXEC.BAT file and save it to the root directory of your hard drive.
- Try changing the SET BLASTER type number (e.g., try T1 or T2). The game may only be programmed to recognize an early version of Sound Blaster. Experiment by using different DMA channels and IRQ numbers with the game's setup utility. If you have a 16-bit sound card, try using the higher DMA channels—4 through 7—for a game and record your results. You can change the DMA and IRQ settings of your sound card in its setup utility program. For Windows games, try altering the sound card driver settings in the Drivers window of the Control Panel. Click on your sound card driver type on the list of installed drivers and click on the Setup button. Write down the original settings before making any changes.
- After you use Windows, a DOS game may produce the wrong sounds. Windows sometimes leaves a sound card in an unstable state. To eliminate the possibility of sound problems in a DOS game after using Windows, exit Windows and reboot the PC first. You should turn the PC off for at least 15 seconds and then turn it back on. If the PC is configured to

start Windows automatically, use the F8 selective bootup routine to bypass processing the WIN command in the AUTOEXEC.BAT file.

Video Problems

- For Windows video troubleshooting, use the Windows setup program to load the Windows VGA or Super VGA video driver and test the game. These generic Windows drivers work with virtually any Windows software program.
- Use the F8 step-through bootup procedure to bypass loading the EMM386 file so no drivers will load into the upper memory area.
- If the DOS video driver file (e.g., a VESA driver) is loaded into upper memory (with the DEVICEHIGH or LH command), try loading it into conventional memory—remove the HIGH or LH statement from the driver line.
- Start Windows in Standard mode by typing **WIN/S** at the DOS prompt. Also try starting Windows without using upper memory; type **WIN/D:X**.
- Use a trial-and-error method of *not* loading certain device drivers from the CONFIG.SYS and AUTOEXEC.BAT file until you discover the problem. Use the F8 step-through bootup procedure to bypass particular device drivers and TSRs one at a time. Log your results and repeat the procedure until you locate the conflicting program.
- Some Windows games use the QuickTime video compression method to store massive amounts of animated graphic files. If video graphics appear scrambled, the colors are reversed or images appear distorted, there may be a problem with the QuickTime compression program. Check the Windows directory for a file called QTW.INI. To do this, type **CD\WINDOWS** and press *e*. Then type **DIR QTW.INI**. If a filename is shown, you can edit it to correct most video problems with your program. The QTW.INI file must contain the following lines to work properly:

```
[VIDEO]
OPTIMIZE=DRIVER  ( or OPTIMIZE=BMP)
```

If the OPTIMIZE= line is set to anything other than DRIVER, change it to appear as shown above. If the line does not exist, create it, save the file, and exit. When you restart Windows, the video images should appear normal.

Pointing Device Problems

To test for an inoperative mouse or serial port, you can use the MS-DOS DEBUG program. At the DOS prompt, type **DEBUG** and press Enter. Then enter **D40:00.** Result:

1st line: F8 03 or F8 02 for serial ports

2nd line: 61 C4 or 65 C4 for existence of a mouse port

When finished, type: **Q** and press Enter to end the program.

To test for mouse movement on the DOS screen, first make sure the mouse driver is installed, then at the DOS prompt enter **DEBUG**. Type **A** and press Enter. The DEBUG program will display a few numbers and letters after each line that you type, but you can ignore them. Type in the following commands, and press Enter between each:

MOV AX,1

INT 33

INT 20

G

You should see a square block near the center of the screen. This is a DOS mouse cursor. Move the mouse around and the cursor should move accordingly. When finished, type **Q** and press Enter to end the program.

You can test a joystick for proper operation with the following QBASIC program.

1. At the DOS prompt, type **COPY CON JOYSTICK.BAS** and press Enter.
2. Type **10 PRINT STICK(0), STICK(1), STICK(2), STICK(3)** and press Enter.
3. Type **20 GOTO 10** and press Enter.
4. Press the F6 key and then Enter.

5. The following message will be displayed: **1 file(s) copied**
6. Type **C:\DOS\QBASIC /RUN JOYSTICK.BAS** and press Enter.
7. Four columns of numbers will appear, displaying the coordinates of the X and Y axis of both joysticks.

   Column 1 is the X coordinate for joystick A.

   Column 2 is the Y coordinate for joystick A.

   Column 3 is the X coordinate for joystick B.

   Column 4 is the Y coordinate for joystick B.

   As you move each joystick, the X and Y coordinate values should change. If no joystick or game port is detected, zeros will be displayed. To terminate the program, press Ctrl+Break.

Disk Compression Issues

The following sections cover common problems with Doublespace and Stacker.

Doublespace Problems and Solutions

To boot up without Doublespace loading, press Ctrl and the F8 or F5 key at bootup time. When you bypass Doublespace, you won't have access to the CONFIG.SYS and AUTOEXEC.BAT files, because they are on the compressed drive. You can copy your system files from the compressed drive to the uncompressed drive (H) before you bypass Doublespace, or you can copy new versions of the files there. You'll also need any programs or device driver files on the uncompressed drive. Pressing Ctrl+F8 will allow you to process the CONFIG.SYS and AUTOEXEC.BAT files one line at a time. Pressing Ctrl+F5 will bypass the system files completely. The computer will not have access to any of the compressed files on the Doublespace drive during this session. If you have to correct a problem with the Doublespace files, you can copy them from your DOS setup or backup diskettes to the root directory of your hard drive.

- If you include the command DBLSPACE/ AUTOMOUNT=0 in the CONFIG.SYS file, Doublespace will only use 34K of RAM. In his mode, you'll save memory, but Doublespace will not automatically mount (or access) compressed floppy disks. You have to manually mount any compressed disks before they can be accessed.
- Doublespace comes with two ways to easily reverse its installation. From the DOS prompt, you can type **DBLSPACE/ UNCOMPRESS C:**. Or you can start the Doublespace program (type **DBLSPACE** at the DOS prompt) and choose the **Uncompress** option from the Tools menu .
- If the fundamental MS-DOS files are not found in the hard disk's root directory, the computer cannot boot at all. To alleviate this situation, boot up from the DOS 6.2 floppy disk and at the A> prompt, type **SYS C:**. The SYS command will copy the crucial DOS files—IO.SYS, MSDOS.SYS, COMMAND.COM, and DBLSPACE.BIN—to the root directory of the hard drive.
- To check the compression ratio of files, type **DIR/C**. You'll see the ratio listed after the file's last-saved time and date. Type **HELP DIR** to learn about more directory command options.
- The Doublespace program has its limits. It can only compress a drive with less than 512 megabytes of data. If your hard disk has more data than this, you'll have to save the files to diskettes or delete them until your total amount is less than 512 megabytes.
- When you back up files on your hard drive, back up the files and directories on the compressed hard drive. Do not back up the compressed volume file on the host computer (DBLSPACE.000). In this manner, you can restore individual directories and files instead of the entire compressed hard drive.
- If the computer becomes unbootable after you use Microsoft Backup or Microsoft Backup for Windows, use the emergency boot diskette to restore the root directory files; boot up from the A drive and type **SYS C:** at the DOS prompt. Note that using the default settings of Microsoft Backup will not replace the critical IO.SYS and MSDOS.SYS at their proper locations in the root directory. Use the SYS C: command to restore the files to their proper locations.

- If you format a diskette from the Windows File Manager, the disk may not be bootable, because the DBLSPACE.BIN file is not copied to it. Copy the file to the disk from File Manager or at the DOS prompt. The file is located in the DOS directory and in the hard drive's root directory (if Doublespace is installed).
- Before you format a floppy disk, access it first by typing its drive letter (e.g., **A:**). Then type **Format A:** (or **FORMAT B:**). This ensures that the disk will be formatted in the Doublespace format.
- Doublespace must be able to write to the diskette in order to access it. To mount a compressed diskette, the write-protection tab must be removed or the write-protect window closed.
- If you've uncompressed the hard drive and the DBLSPACE.BIN and DBLSPACE.INI files are still located in the root directory (C:\), DBLSPACE.BIN will load at bootup time, occupying 34K to 43K of memory. To fix this situation, use the Windows File Manager or DOSSHELL to delete both Doublespace files from the root directory. These files may be hidden and read-only, so you'll have to remove those attributes from the files before they can be deleted. Use the Help menu for information about file attributes.
- When using a virus-checking program like the DOS 6 MSAV utility, be sure to scan both the host and compressed drives.

Stacker Versions 1, 2, and 3 Problems and Solutions

- If a driver or program is not located on the proper drive, you'll receive a message such as **Bad or missing driver** or **Error in CONFIG.SYS line *xx***. You'll have to copy the driver or program file to the proper directory on the host (D:) drive.
- To conserve conventional memory, the STACKER.COM file can be loaded into upper memory. Edit the file line to read:

```
DEVICEHIGH=C:\STACKER\STACKER.COM
```

The SSWAP.COM file is not memory-resident and doesn't need to be loaded high.

- To defragment the Stacker compressed drive, use only the SDEFRAG program that comes with STACKER. You can use any other disk optimizer software to defrag the host (uncompressed) drive.
- The Windows swapfile must be located on the host (uncompressed) drive. When Stacker installs, it relocates the swapfile to the host drive. If a new copy of Windows is installed after Stacker is installed, you must place the swapfile on the uncompressed drive (usually D). From the Windows Main group, double-click on Control Panel. Choose the 386 Enhanced icon. In the dialog box that opens, click on the Virtual Memory button. The next screen will show the size and location of the present swapfile. Delete the current swapfile and create a new, permanent one on the host drive with the size you prefer.
- If you use a disk-cache program like DOS Smartdrive, cache *just* the host drive, not the Stacked drive. For instance, to set Smartdrive to cache the host drive D and not C (which is the compressed drive), include the following parameters on the Smartdrive line: C:\DOS\SMARTDRV.EXE C- D. The C- parameter tells Smartdrive not to cache the C drive.
- When you install Stacker, the drive-letter designations will change on your system. This may present a problem for an installed CD-ROM drive (or one that you install later), which is usually referred to as drive D. You can run the Stacker program and alter the letter of the host drive to fix this problem. See the Stacker manual for more details.
- *Note to owners of Stacker version 2:* Stacker version 3 (and above) includes the option to use the UNSTACK command to reverse the installation process. It will uncompress the drive and return it to its original state. See the Stacker manual for more details. Stacker version 3 includes the UNSTACK command to uncompress a Stacked drive.

There must be enough room on the uncompressed host drive to contain all of the compressed files from the compressed drive before the uncompression routine can proceed.

To check for disk space size requirements before using the UNSTACK command, you can use the CHECK command first. At the DOS prompt, type **CHECK /D**. This will give you detailed information about the compressed drive. If

your Stacked drive has another drive letter—F, for example—put that drive letter and a colon after the CHECK command: Enter **CHECK F: /D**. To unstack a Stacker compressed drive, you can type **UNSTACK C:**. If your compressed drive has a different assigned letter, substitute that letter after the UNSTACK command.

- To see the compression ratio of files on the Stacked drive, type **SDIR** at the DOS prompt. You'll see a normal directory listing of the directory's filename, size, date, and compression ratio.

- To boot up without loading Stacker, just press the F8 or F5 key at bootup time. The F8 key will allow you to process the CONFIG.SYS and AUTOEXEC.BAT files one line at a time. If you bypass the two Stacker file lines, the compressed drive will not be accessed and the drive letters will not be swapped. You will only have access to files and programs on the host (uncompressed) drive during this session. Pressing the F5 key will bypass processing the CONFIG.SYS and AUTOEXEC.BAT files completely. The compressed drive will not be accessed and the drive letters will not be swapped. You will only have access to files and programs on the host (uncompressed) drive during this session. The computer will not have access to any of the compressed files on the Doublespace drive during this session. If you have to correct a problem with the Doublespace files, you can copy them from your DOS setup or backup diskettes to the root directory of your hard drive.

Stacker Versions 3.1 and 4.0 Problems and Solutions

- The Stacker loading method changed radically starting with version 3.1. To use the newer version, MS-DOS 6 became a requirement to install the program. In fact, Stacker uses the DOS 6 DBLSPACE.BIN automatic loading capability to install the Stacker program file. Owners of Stacker versions 3.1 and 4.0 should read the previous section for an overview of the Doublespace program and then read this section carefully to learn about the Stacker bootup process.

- There is a DBLSPACE.SYS file in CONFIG.SYS, but its purpose is to relocate the DBLSPACE.BIN file from conventional memory into the upper memory area.
- The Stacker DBLSPACE.BIN file is not the same file that comes with DOS 6. It is similar to that file in name only. Since the computer searches for the DBLSPACE.BIN file and loads it into memory, Stacker takes advantage of this to load its own program in the same fashion. DOS does not check the validity of the file, just the name and location; it must be located in the root directory.
- The Stacker DBLSPACE.BIN file is 57510 bytes long. The DOS 6.0 DBLSPACE.BIN file length is 51214. The DOS 6.2 DBLSPACE.BIN file length is 64246. MS-DOS versions 6.21 and 6.22 do not include a DBLSPACE.BIN file. This information is included so you will not delete the Stacker DBLSPACE.BIN file from the root directory, mistakenly thinking it is unnecessary.
- Using the SYS C: command could be dangerous. This command, used at the A prompt will transfer all of the crucial DOS startup files to the hard disk's root directory, including IO.SYS, MSDOS.SYS, COMMAND.COM, and DBLSPACE.BIN (the DOS version of this file). When you reboot the computer, your Stacker compressed drive will not be mountable until the Stacker DBLSPACE.BIN file is copied from the installation disk to the root directory.
- To boot up without loading Stacker, press the Ctrl and F8 or F5 keys at bootup time. When you bypass Stacker, you won't have access to the CONFIG.SYS and AUTOEXEC.BAT files, because they are on the compressed drive. You can copy your system files from the compressed drive to the uncompressed drive (H) before you bypass Stacker, or you can copy new versions of the files there. You'll also need any programs or device driver files on the uncompressed drive. Pressing Ctrl+F8 will allow you to process the CONFIG.SYS and AUTOEXEC.BAT files one line at a time. Pressing Ctrl+F8 bypasses the system files completely. The computer will not have access to any of the compressed files on the Stacker drive during this session. If you have to correct a problem with the Stacker files, you can copy them from your DOS setup or backup diskettes to the root directory of your hard drive.

Windows Problems and Solutions

- When installing Windows games, always refer to the manufacturer's instructions. Without a manual, there are two alternate methods to install Windows programs. First, from the Program Manager screen, click on the File menu and select **Run**. Then type in the commands given with the game's instructions to install the program. The command will typically be **A:SETUP** or **A:INSTALL**. If the game doesn't install or if you get error messages on the screen, you can try the second installation method. From the Windows Main group, click on File Manager. With the diskette in drive A, click on the A disk drive symbol at the top-left corner of the screen. Then look at the file listing in the right column for the SETUP.EXE (or INSTALL.EXE) file and double-click on it. The installation program will begin.
- MS-DOS games shouldn't be run in Windows. They either won't load or you'll receive "sound contention" errors on the screen. Even if they do run properly, you wouldn't want your PC to lock up while Windows is still running; this can corrupt or destroy critical Windows files.
- If you get this message after you load a game: **DMABufferSize is too small. Set to 32**, you can edit your Windows SYSTEM.INI file to solve the problem. To edit the file in Windows, at the Program Manager screen click on File and choose Run. On the Run line, type **WIN.INI**. A Notepad screen will appear with the SYSTEM.INI file on it. Locate the [386Enh] section of the file and find the line that says DMABufferSize=*xx*. You must increase the number given to the number that the game program recommended. If you do not see a line like this, create one (be sure to make the capitalization match the line given here), for example: DMABufferSize=34. Save the file, exit and restart Windows. The game should now load correctly.
- If you've changed your video display driver in Windows and it has blacked out the Windows screen, you can get to the Windows setup program from the DOS prompt. At the C:\ prompt, type **CD\WINDOWS**. Then type **SETUP**. You'll see a display line with the name of the new display driver. Highlight it and then chose the display driver you had previously.

Hit Enter three times and you'll be left at the DOS prompt. Type **WIN** and press Enter; Windows will start.

- Some Windows games use the QuickTime compression method for producing high-resolution graphics. You can check this possibility by viewing the QTW.INI file. In Program Manager, click on the File menu and choose Run. Type **QTW.INI** on the Command Line and hit Enter. You'll see a Notepad screen displaying the file text. Make sure that the [VIDEO] section of the file contains a line that states OPTIMIZE=DRIVERS or OPTIMIZE=BMP. The line may instead read: OPTIMIZE=HARDWARE. If it does, change it. If there is no such line in the [VIDEO] section, create one, and save the file, and restart Windows. The video graphics should now look fine.

- If you start Windows by typing **WIN /B,** a file called BOOTLOG.TXT will be created in the Windows directory. The file will list the various device drivers that are needed to load Windows. You can view the file with the DOS EDIT program or with the Windows Notepad. Look at the last few lines, to find out which file failed to load.

- Video problems in Windows can be caused by an improperly loaded video driver or a corrupted driver file. If you start Windows and it blacks out the screen, displays poor video images or bounces back to the DOS prompt without displaying an error message, then suspect a bad or incorrect video driver.

  You can easily test this theory by changing to the standard VGA driver that is included with all versions of Windows. From the DOS prompt, change to the Windows directory, type **CD\WINDOWS**, press Enter, and then type **SETUP**. Look at the driver shown on the display line and highlight it by using the arrow keys. Hit Enter and you'll get a list of the video drivers. Scroll down the list until you get to the VGA driver, and hit Enter again. Hit Enter twice more and you should be back at the DOS prompt. Type **WIN** to enter Windows and you should see a plain Windows display.

- If a game program or another software application has improperly rewritten your Windows WIN.INI or SYSTEM.INI files and you don't have backup copies, you can copy the original versions from your Windows installation diskettes.

They are compressed on the disk under the names WIN.SR_ and SYSTEM.SR_. First, copy the present files from your Windows directory to another directory. When you locate the disk with the files on it, you can expand and rename them by entering the following command: **EXPAND A:WIN.SR_ C:\WINDOWS\WIN.INI**. Substitute the SYSTEM.INI filename for the WIN.INI filename to expand and copy it to the Windows directory. Windows should load properly. It will not have any special icons or settings as it did before, but it will run. Compare the old and new versions of the files to troubleshoot the cause of the problem. The underlined character, "_", in a filename indicates that the file is compressed.

- If Windows fails to start or locks up during startup, you can launch it with WIN/B and it will create a file called BOOTLOG.TXT. This file keeps track of everything that Windows does to run and load program files. When you start Windows with the /B switch, it will write information to the BOOTLOG.TXT file about every single file needed to start a Windows component. After the computer fails to start Windows, you can use the DOS Edit program to view the file. To view the BOOTLOG.TXT file, change to the Windows directory. Type **CD\WINDOWS**, press Enter, and then type **EDIT BOOTLOG.TXT**. The DOS Editor will display the file contents. A typical listing will look like this:

```
LoadStart=MOUSE.DRV
LoadSuccess=MOUSE.DRV
```

Look at the last few lines of the file. It will show the name of a file that failed to load. For example: LoadFail=WIN3DRV. Write down the name of the file and locate it on one of your Windows disks (or extra driver disks if it is a video driver, sound driver, etc.).

- Perform a disk check to search for any corrupted files. Then reboot, exit the DOS Edit program and at the DOS prompt, type **CHKDSK/F**. Answer **Y** for Yes if you are asked **Do you still want to run checkdisk?** If any cross-linked chains or lost allocation units are found, answer **N** (for No) to the question **Convert loss chains/allocation units to files?**

- Check the items in the Windows Startup group before loading an application. If you have a recurring problem with a Windows application, start Windows by holding down the Shift key after you type **WIN** to start Windows. This will prevent it from loading any applications from the Startup group. If the game lockup problem ceases, you can find the conflict by starting each program from the Startup group and then loading the program. After running the first application successfully, stop them from running and load the next application and the game. By trial and error, you'll find which application is causing a conflict in Windows.

- Other Windows applications may be loading in Windows at startup time without your knowledge. The Windows WIN.INI file in your Windows directory sets parameters that Windows follows during startup time. There are two lines in the file that can automatically load programs. They are the LOAD= and RUN= lines. To see what your Windows WIN.INI file looks like, go to the Program Manager screen, pull down the File menu (click on File or hold down Alt+F), and select the Run option. Type **WIN.INI** on the Command Line and hit Enter. A Notepad screen of the WIN.INI file will appear. Check the lines in the WIN.INI file that begin with LOAD= and RUN=. If there is nothing else on the lines, then they will not load any Windows applications.

  If there are other items on either of the lines (e.g., LOAD=C:\WINDOWS\POINTER.EXE), you can have Windows bypass loading the application(s) by placing a semicolon and a space at the beginning of the line (e.g., ;LOAD=C:\WINDOWS\POINTER.EXE).To have the changes to the WIN.INI file take effect, you must close the Notepad program—hold down Alt+F8 and choose Exit. Save the changes to the file and exit from Windows. When you restart Windows, it will not load the application(s). Then you can see the difference it makes to the application.

- You can monitor the Windows resource level from the Program Manager screen by clicking on the Help menu and choosing About Program Manager. You'll get a message at the bottom of the dialog box that shows available memory and system resource levels. The memory free represents the

Windows swapfile settings chosen in the Control Panel's 386 Enhanced window. The system resources percentage free statement displays the lowest percentage of free space in one of four *heaps*, each heap containing a 64K segment of memory that handles part of the Windows graphical environment.

☞ There are ways to keep the Windows resource level high, which will prevent game loading and lockup problems. Most of the methods deal with reducing the amount of graphical images in Windows to a minimum. Producing high-resolution images takes a lot of computing power, especially when Windows has to redraw screens.

Before launching a Windows game, check the system resource percentage free. If it is not above 80 percent, then you can do the following:

1. Check the Windows Task List to see how many applications are running. Double-click the mouse on the Windows Desktop or press Ctrl+Esc. Quit any active programs on the list (except the Program Manager).
2. Keep the number of open Window groups and dialog boxes to a minimum.
3. Keep the number of fonts loaded at startup time to a minimum. Check the Fonts window in the Control Panel and remove any fonts you do not use. This will make Windows load faster, too.
4. Deactivate any wallpaper or screen savers you have loaded. To do this, use the Desktop option from the Control Panel.
5. If open programs have any toolbars or ribbon selector options, remove them from the screen. Keep any open application screens as plain as possible graphically.
6. Check the video resolution that Windows is running in. Keep this to the minimum at which Windows can run all of your applications—usually 640 × 480 with 256 colors.
7. Drag all of the most frequently used icons into one or two Window groups. Close all other Window groups or keep them minimized.

As you use Windows applications, some files can become corrupt from usage or they may have problems working with certain software drivers. Here are a few tips to prevent General Protection Faults (GPF) while running Windows:

1. If you have been using Windows for a long period of time, check the system resource level. In Program Manager, click on the Help menu and choose About Program Manager. Look for the percentage free statement at the bottom of the dialog box. If the Windows system resource level goes below 60 percent free, GPFs can occur.
2. Perform a disk check on your program files often—about once a week—to detect corrupt files early.
3. Obtain and install the latest versions of all driver files used with your system, including video drivers, sound drivers, CD-ROM drivers and other drivers listed in your CONFIG.SYS and AUTOEXEC.BAT files. Check the Microsoft BBS for any updated drivers.
4. Bad or corrupted video and audio device drivers can cause GPFs. Change to the plain VGA video driver and restart Windows. Or obtain the latest video and sound card drivers from the original manufacturers and install them.
5. Try running Windows in Standard mode to stop GPFs. At the DOS prompt, type **WIN/S**. See if the GPFs disappear.
6. Try running Windows without using any upper memory; type **WIN/D:X** at the DOS prompt. If the GPFs do not appear, check the CONFIG.SYS to ensure that the EMM386.EXE line has the correct exclusions at the end of the line. This usually occurs after installing a new MS-DOS version.
7. Bootup with a minimum configuration. By holding down the F8 key before you see the **Starting MS-DOS** message, you can process just the files needed to run Windows. Essentially the only file necessary to run Windows is HIMEM.SYS. From the AUTOEXEC.BAT file, just process the PATH line. Start Windows and try to recreate the conditions that produced the GPF.

If none are detected, reboot the PC, process more lines, and note the difference. Notice which file processed on that session caused a GPF.

8. To isolate Windows game conflicts, ensure that no other programs are loading or running when Windows starts. Check the Startup group for any icons. If there are icons there, drag them to another group window temporarily, and restart Windows. Check the WIN.INI file for any programs or utilities loading; the lines LOAD= and RUN= should be blank. If they are not, place a semicolon and a space in front of the lines so that Windows ignores them(e.g., ; LOAD=). Also, turn off screen savers, unload wallpaper designs and deactivate any timer, alarm or reminder programs that may be running.

9. Make sure the SYSTEM.INI file loads the standard Windows drivers for MOUSE.DRV,COMM.DRV, KEYBOARD.DRV, and SYSTEM.DRV. These lines should equal their own names, for example: MOUSE.DRV=MOUSE.DRV. If these lines equal other driver names, write down the lines, edit them as noted above, save the file, and restart Windows. If you stop getting GPFs, isolate which driver file is causing the problem and request an updated version from the program manufacturer. If the general protection fault keeps appearing, edit the files to their original settings.

10. If Windows produces a general protection fault when you load the EMM386.EXE file, you can prevent Windows from using upper memory. At the DOS prompt, type **WIN/D:X**. See if Windows produces any more GPFs. If they stop appearing, then Windows is trying to use an excluded area of upper memory that it shouldn't (again, if you have Windows 3.0, you should upgrade to version 3.1).

☞ Another loading problem can occur when you click on a Windows game icon and you get this message:

```
Cannot find file or one of its components. Check
to ensure that the path and file name are correct
and that all required libraries are available.
```

- This means that Windows didn't locate the game startup file where it should be located on the hard disk or some of the other program files that make up the program. Windows stores the startup filename and directory location of your game program in a "program item properties" information file.

  You can see this information by holding down the Alt key while you click on the game application's icon. If everything looks okay, it usually indicates that there are corrupt files in your game directory or files missing altogether. It would be wise to reinstall the program. If necessary, reinstall the file into a new directory and try running the application again. If it works, delete the files from the original game directory to save hard disk space.

- If a CD-ROM drive cannot be accessed from Windows and doing a DIR command at the DOS prompt gives the error message **EMM no longer valid, CDR 102**, check the MSCDEX.EXE file line in the AUTOEXEC.BAT file. If the line has a /E in it, remove the /E from the end of the line, save the file, and reboot the computer. Loading MSCDEX into conventional memory will also solve this problem.

- If you have Windows For Workgroups 3.11 and are not connected to a workgroup, you can start Windows with the WIN/N command for faster loading and exiting. The /N designation will prevent Windows from searching for a network connection during startup and exit.

- If you have Windows For Workgroups 3.11 and are experiencing lockup problems, disable the 32-bit *file access* option (not to be confused with 32-bit *disk* access). It is accessible from the Control Panels's 386 Enhanced window. Click on the Virtual Memory button and choose the Change option. By default, this option is not turned on. But if you have turned it on, turn it off if you experience inexplicable behavior from Windows games. You will have to restart Windows for the change to take effect.

- If you turn on the 32-bit disk-access option in the Control Panel's 386 Enhanced window and Windows will not load, you can edit SYSTEM.INI to resolve the problem. Look for a line in the file under the [386Enh] section that states: 32BitDiskAccess=on. Simply change the On designation to Off (32BitDiskAccess=off), save the file, and restart Windows.

- Use the latest versions of your MS-DOS driver files, including HIMEM.SYS, EMM386.EXE, MSCDEX.EXE, and MOUSE.COM or MOUSE.SYS. Write down which versions you are using; at bootup, look carefully at the screen and you'll see which versions of HIMEM.SYS and MSCDEX.EXE are loading. Type the remaining filenames at the DOS prompt to see which versions are presently installed.
- Call the manufacturer of your Windows games and request the latest version of the application. Ask about any known conflicts and if there are "patch" disks available to solve them.
- If you have recently installed a sound card and your PC already comes with a joystick port, make sure you keep the port on the card deactivated.
- If a game locks up or won't load for some reason, turn off EMS (expanded memory support). Step through the CONFIG.SYS file and bypass EMM386.EXE or edit it to say NOMS. If you get a message that says a game needs to turn off DPMI support, turn off EMS.
- If a game gives you an "out of memory" error in Windows, try exiting and starting the SHARE.EXE program: type **C:\DOS\SHARE.EXE** at the DOS prompt. Then re-enter Windows.

Part 2

Assessing Games and System Requirements

Most game users evaluate a game before buying it simply by looking at the requirement sticker on the back of the package Although this is an important item to check, it should be just the beginning of a thorough checklist you go through before purchasing any DOS or Windows game.

This chapter will help you prevent problems with games before you purchase them. No doubt the reason you are reading this book is because you've already had problems with "PC-compatible" games. I emphasize the computer type because of an anomaly with PC-compatible software—especially games! Almost no two PC-compatible computers are configured alike, and virtually no game that is released has been tested on every configuration of PC compatibles!

The very nature of an IBM PC-compatible means that it has to adhere to a standard—and yet it cannot be manufactured *exactly* like an IBM PC. Even the IBM PC is not totally "compatible" anymore. Some IBM models have MCA (Micro Channel Architecture), which is a non-standard expansion bus. Other models come with IBM PC-DOS—not MS-DOS. Some problems can occur when attempting an MS-DOS upgrade to PC-DOS software.

The first step is to record all of the hardware and operating system information about your computer. Check the "Before You Begin" section for more information about determining pertinent information about your computer, peripherals, and MS-DOS version.

PCs require updated MS-DOS versions and newer device drivers in order to make advanced software programming code and new hardware devices work with the original IBM PC. This keeps computing moving forward while retaining backward compatibility.

Game software programs use nearly every part of your PC's hardware; and often in ways that regular business programs never do. In order for games to display fast, video quality animation with stereo sound, the programs write directly to your PC's port addresses and to video RAM. More conventional memory must be available in order to load a game program. Hard disk drive space requirements for some modern games are as big as whole hard drives were a few years ago.

The aforementioned points are made to remind you to be a little cynical when evaluating the next game you'd like to buy. First, let's evaluate a typical game requirement sticker for some basic points to look for.

A Sample Game System Requirement List

In the following sections we'll analyze the typical system requirements given on a computer game box. For example, you might find this list for a PC-compatible game called "Mys-Take 4":

Requirements:

- IBM or 100 percent compatible
- MS-DOS 5.0 or higher
- 386 or higher processor
- 2 megabytes (MB) required
- 256 color VGA/MCGA
- 15 megabytes of hard disk space
- Sound card
- Joystick or mouse

What looks like a typical PC game requirement list can be misunderstood in many ways. We'll cover each line and see how you should be wary of game manufacturer system requirement claims. Later in this section, you'll learn how to uncover more background information to see if the game will actually install and run on *your* PC compatible.

IBM or 100 Percent Compatible
Most PC-compatible users assume that their computer is a true clone, but many manufacturers make changes to the basic design of their systems for competitive marketing reasons. Some manufacturers incorporate on-board sound, specialized ports, and other hardware differences to stand out from the crowd. Remember, not all PCs are created equal.

MS-DOS 5.0 or Higher
Remember, DOS types aren't all coded the same way. Many major PC compatible makers alter their version of DOS to optimize their machine's performance. But some of these deviated DOS versions can balk at some advanced game program code.

386 or Higher
This specification doesn't state what speed or type of 386 CPU is required for smooth operation. Is a 386SX 16Mhz needed? Or is a 386DX 33Mhz the minimum processor that should be used to obtain adequate video animation with non-delayed sound playback?

2 Megabytes Required
"2 megabytes" doesn't begin to describe what kind of memory is required. Does the game require any expanded memory (EMS) to be made available before loading? What kind of extended memory management (XMS) is necessary? Does the program include its own memory management utility? Does it take into account that most users will have a hard disk drive cache program running that reserves RAM for its own use? Must the hard drive cache (e.g. the DOS SmartDrive program) be disabled first? Most importantly, how much conventional memory should be available to load the game?

256 Color VGA/MCGA
Video resolution and color mode are important specifications to confirm. In this case, is a special DOS video driver (a VESA driver) needed by the user or will it be supplied by the game program? Can the game be run in Windows and use its video driver? Most importantly, is the game software compatible with the video card installed on *your* PC?

15 Megabytes of Hard Disk Space
This isn't an unreasonable requirement for a modern game that has all the bells and whistles. But, does "15 megabytes" mean that the entire game is installed on the hard drive or do other files have to be loaded from diskette or CD-ROM for access to other game levels? Can the game run on a compressed hard drive well (or at all)? Will it create any temporary files as it runs that may be hidden (and not get deleted)? Will it create directory names (using illegal DOS characters) that cannot be deleted? Is a fast hard drive required for optimal performance (with a low access-time rate)? Is a hard disk cache program needed for non-jerky video and sound output? If so, what should the cache size be set to? With a CD-ROM game, can the complete program be installed on the hard drive and then played without the CD-ROM device drivers installed (to provide faster game play and more conventional memory available)?

Sound Card
What kind of sound card is supported is critical in game play. Most games indicate that a Sound Blaster-compatible card will suffice. But does the card have to be Sound Blaster-*compliant* also? The Sound Blaster card type needed for compatibility is important to know: Should you have the original version? Sound Blaster Pro? Sound Blaster16? Will your sound card be able to generate *all* of the game's sounds? Games can produce VOC, Music, and MIDI sounds in different ways, and the setup program information is crucial. If no sound card is installed, will you miss any critical game information? For instance, if a game character speaks, will you be able to proceed with the game without hearing what is said? Can the PC speaker suffice as a sound source?

Joystick or Mouse

Are these two pointing devices absolutely necessary? If you are at work or using a laptop, can you still use the keyboard to play the game? In the case of a joystick, does the game use the standard I/O address for the joystick port or some non-standard memory address? Can a special joystick which requires a device driver to be loaded in memory be used with this game? In the case of a mouse, which mouse driver is needed? Can the Microsoft mouse driver (included with Windows 3.1) suffice? Does the program come with its own mouse driver? And does it easily recognize a mouse connected to a different port (e.g., the expansion bus or a PS/2 port)?

Other Technical Requirements to Consider

The sample requirement list earlier made no mention of these important considerations:

- Diskette size included
- Windows and other operating system compatibility
- Files/buffers/stacks requirements (in the CONFIG.SYS file)
- Whether a boot disk is necessary to run the game
- Device driver and TSR (terminate and stay resident) program necessities
- Conflicts with certain hardware and software
- Whether the game is copy-protected

Remember, a game package has limited space to list technical requirements. The primary purpose of the package is to sell the game, not to scare a potential customer with too many restrictions.

Research Resources

Once you know what to look out for before purchase, you'll need to know how to find out more about the game program and its manufacturer. The following three avenues of information will assist in your quest for game program information.

People Ask your game-playing friends, coworkers or associates about the program. If you find someone that already owns the game, find out as much as you can about any problems running it and availability of technical support. If possible, ask to see the game manual for explicit installation instructions, trouble-shooting information and a technical support number.

Also, obtain as much information about their computer as possible to see how closely its hardware and software configuration matches yours. Here are some other good sources of information:

- PC user groups
- Magazine reviews of the game
- Bulletin board services (BBSs)
- Game forums on online services such as CompuServe, GEnie, and ZiffNet

Store Demonstrations The best way to evaluate a game is to see it running on a computer. But don't stop there. Kindly ask the salesperson to show you the display computer's CPU type and speed; configuration files; sound card type, and video card type. Also ask to see the game program's setup or configuration program. Find out about the store's return policies, too.

Be patient. This type of extensive evaluation takes time and the salesperson may want to assist other customers while obtaining the information you request. Be sure to buy your games and other computer items from a salesperson who gives you this kind of extra assistance—even if you could save a few dollars elsewhere. Finding a knowledgeable and patient salesperson is important for future purchases (and product evaluation).

When you establish a good relationship with the sales staff, they'll no doubt inform you of potential conflicts and known bugs with certain games before you buy. Also, they may inform you of upgrade version and patch programs for your games when available. Return their helpfulness by referring your friends and other game users you know to the store.

The Game Manual However you can get your hands on it, whether it is obtained from a friend or at a store, the game manual will give you important background information on the game and the manufacturer. Here are some things to look for:

- Is it neat and printed on good stock? Is it a slim pamphlet or a complete manual with game installation instructions, loading information, and more? The manual included with a game is a direct reflection of the company that makes the application.
- Does the game manual include game hints, or does the game manufacturer want you to call a toll number for hints, tips, and secrets?
- Are extensive troubleshooting tips included? Are they clear and easy to follow?
- Does the manual go into more detail about system requirements, hardware configuration, and possible software conflicts?
- Most importantly, is a technical support number available? Is it toll-free? Is there a separate line available for game hints?
- Does the game maker have a bulletin board service, or is help available on a popular online service like Prodigy, CompuServe or GEnie?
- Do they have an address where you can write regarding non-critical issues? Is a fax number available?
- If a tech support number is available, call it and see how long it takes to get through. Have your computer specifications ready and ask about any known conflicts with your PC model, sound card type, and video card type. Ask if any special device driver programs are necessary before loading. Ask about memory requirements and other technical questions you may have. Evaluate how helpful and forthright the support staff is.

Pre-Loading Safeguard Checklist

Before rushing to load a new game, perform the following steps to ensure proper operation and to maintain your system integrity. The steps below will also be of tremendous help if you need to troubleshoot a problem later—either on your own or with a tech support person.

- Read the manual.
- If you come across anything incomprehensible or unusual, call tech support or the retail vendor before installing the program.
- Copy-protect the disks.
- Scan for viruses.
- Copy and print DOS and Windows system files. Rename and save them to diskette and to the root directory.
- Monitor installation. Note configuration information requested and directory name created.
- Check disk space occupied.
- Check system files and compare to old ones for reference; note any alterations made.
- Check sound card mixer levels.

Part 3

Memory Issues

If you've loaded many games, you've undoubtedly encountered (or will soon encounter) "out of memory" messages. This befuddles most users, since modern PCs include more total memory than a game requires. But games are fickle. They prefer to use only the memory that is available in the 0 to 640-kilobyte (K) area called the *conventional memory* area. Other games want you to configure your memory to act as *expanded* memory. The key to understanding memory issues is to think of the original IBM PC's capabilities, not how they're configured now.

PC-Compatible Memory Types and Configurations

This section will use a PC-as-house analogy to explain memory issues that confuse many PC users. You'll learn how to configure your system memory to its maximum potential and how to use the DOS MemMaker utility.

Why Games Differ from Other Software Programs

To quickly understand how a PC's memory system is designed and allocated for use, we'll use a PC-as-house analogy. Your PC's conventional memory can be thought of as your living room

floor area. Any other memory is located on upper floors. The upper memory area (from 640K to 1MB) is located on the balcony. The rest of your memory (1 MB and up) is located on upper floors. In the house are personnel to keep it in good working order—your basic DOS system files, MSDOS.SYS, IOSYS, and COMMAND.COM—plus device driver files needed to manage your memory (HIMEM.SYS and EMM386.EXE) and initialize your installed hardware and drivers for the sound card, mouse, and the CD-ROM drive. The living room is considered the working area where your applications perform their tasks.

A typical software application, such as a word processor, takes up very little space in the "living room". If a secretary (or word processor) comes to the house, he arrives alone with only writing materials and a typewriter. He can easily fit into your living room to take dictation, edit your materials, and print out the data. Your accountant (a spreadsheet) also has room to take in your data, calculate it, and store and print the results. Notice that these two applications are compact in design and work discreetly based on your commands. Let's contrast this with a typical game program.

A game program fills the "living room" completely. When a game arrives at the PC house, it wants to bring along a huge band, smoke generators, a high-tech light show, dancers, and elaborate, movable sets. There is not enough room for the game, the device drivers, *and* the DOS system files in the living room (the conventional memory area). Since the game arrived last, it's the one that will get booted out.

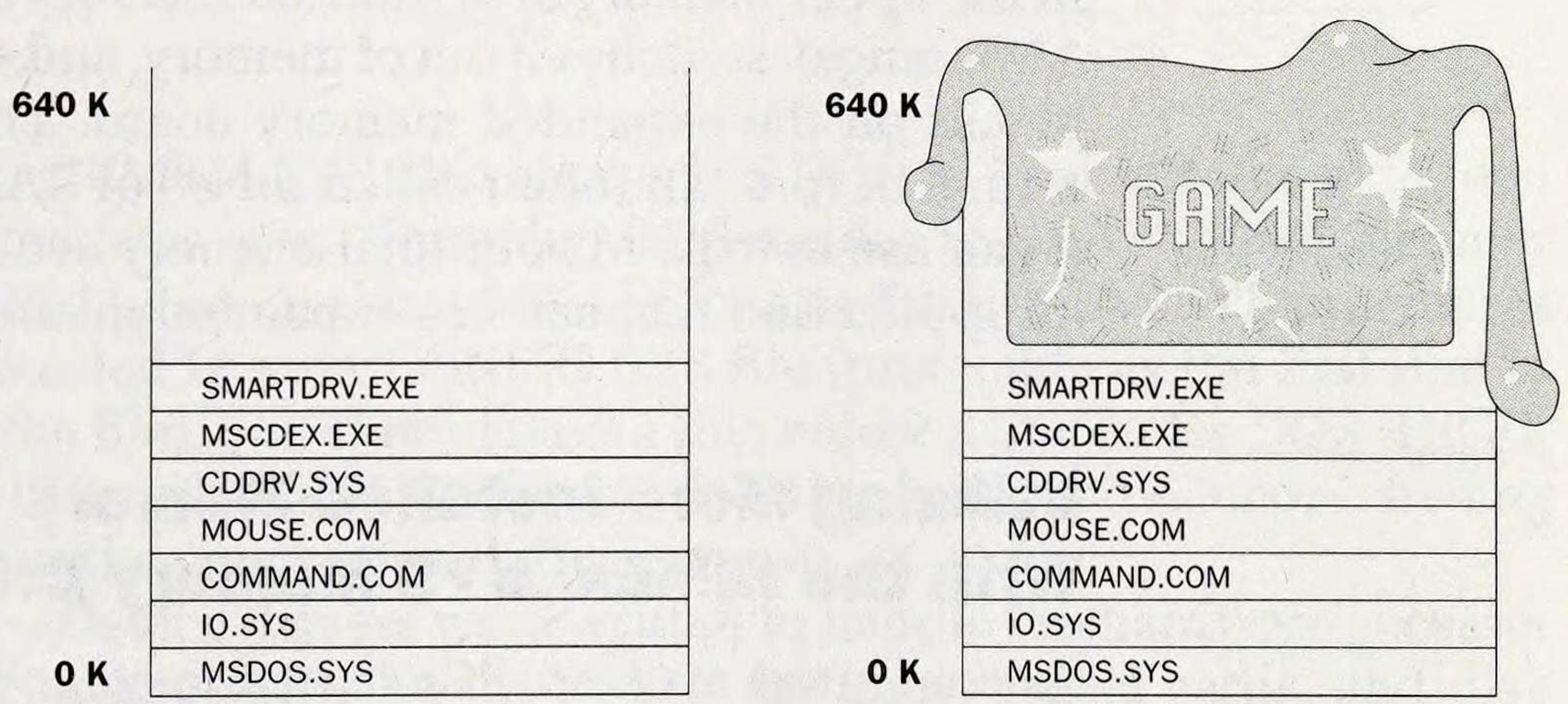
IBM PCs—the Beginning

The IBM PC was originally designed to give software applications a 512K maximum memory area (the conventional memory area or base memory). Later, another 128K area of adjacent memory was allocated to program use. Actually, MS-DOS can address 1 megabyte (MB) of random access memory (RAM), but some memory blocks in the upper memory area (the memory addressed from 640K to 1 MB) are used by the PC's hardware for maintaining the keyboard, video, and accessory ports (for the printer, mouse, and serial ports). Since MS-DOS programs can use only a *contiguous* block of memory (memory sections that are right next to each other), the largest possible memory space a game can use is 640K.

When programs were designed for the PC in the early to mid-1980s (including games), they were designed to load and run in the conventional memory area, leaving plenty of room for the DOS system files. At that time very few device driver files were necessary, because there weren't any hardware devices available to install.

PCs came installed with 512K or 640K of RAM, which was ample for programs at the time. But soon programs became feature-driven and then the memory problems began.

In the early 1980s, there was little need to use any of the upper memory area from 640K to 1 MB. MS-DOS programs (games included) had to initially load in the conventional memory area only. But there were already DOS programs (your system files) and device driver files loaded in this area. See the following illustration for a vertical representation of your game trying to fit into the conventional memory area without overflowing.



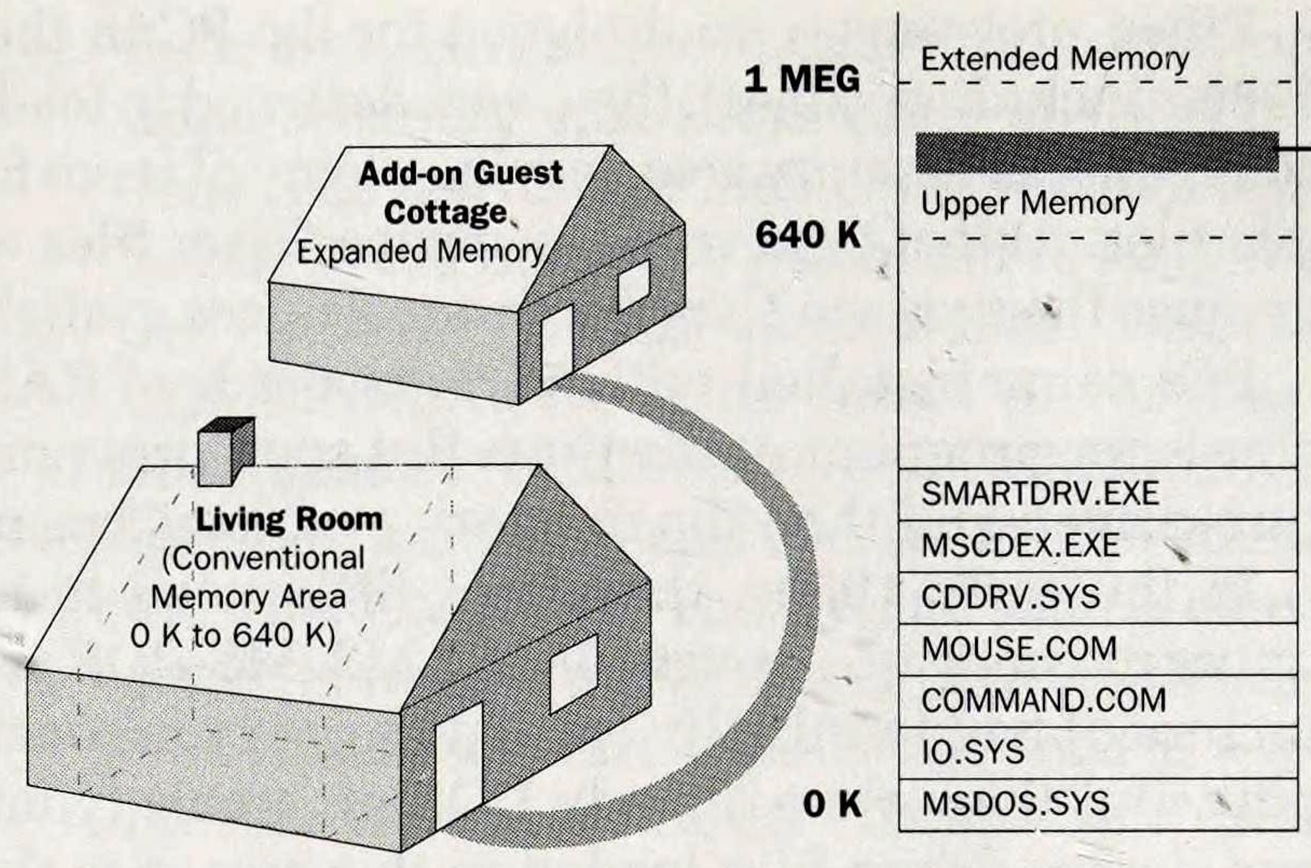
With DOS and device drivers already loaded, the game program "overflows" and cannot load in the remaining conventional memory area.

Using DOS Memory Management Utilities

"Expanding" Memory

The first solution to memory constraints was introduced by using an add-on hardware board to provide *expanded memory* (also known as *EMS*). Using our PC-as-house analogy, expanded memory could be considered a rec room extension added to the side of the house. To use expanded memory, you must have an application program that was written to use it, the expanded memory board, and a device driver program (sort of a translator) that works between the computer and the board. The device driver program is called an *expanded memory manager*.

Expanded memory can be thought of as an add-on guest cottage in our PC-as-house analogy.



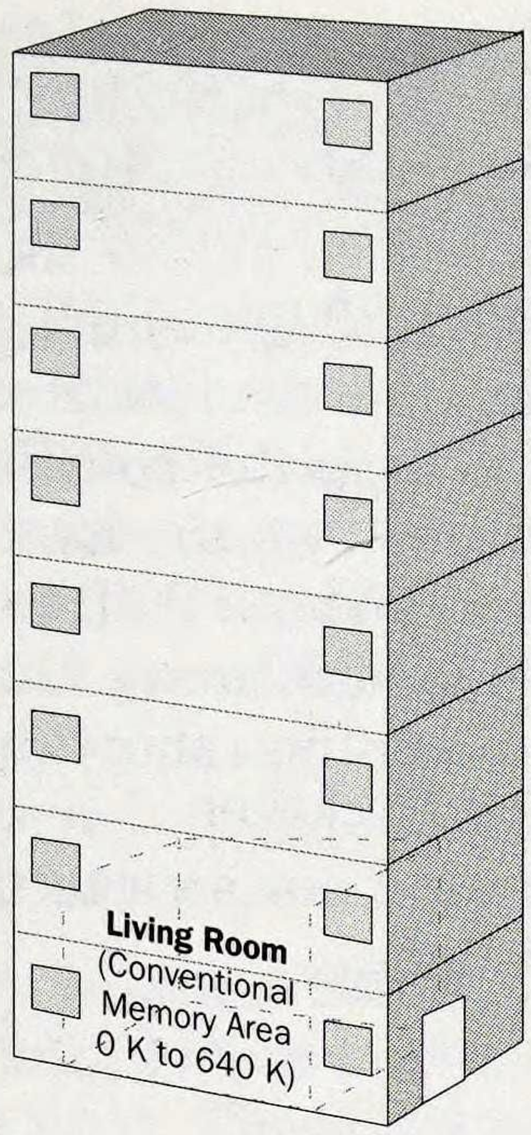
The expanded memory format uses a free 16K memory block in the upper memory area (unused memory areas in the 640K to 1 MB range), switches it out of memory, and substitutes memory blocks on the expanded memory board. The board may have from 64K to 4 MB (often called *megs*) of RAM installed, which it can use to expand your total memory available—but only for an application that can use expanded memory.

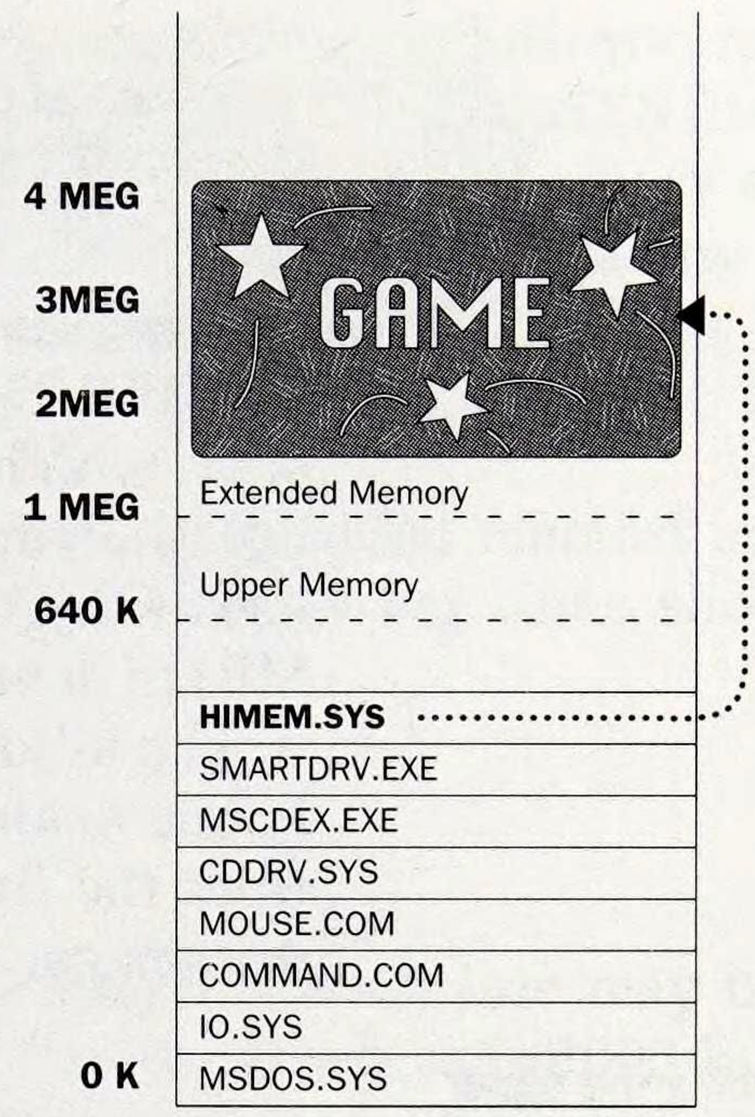
Utilizing More Installed Memory With the HIMEM.SYS Memory Driver

As computers evolved, PCs started to come with 1, 2, and 4 MB of RAM installed; a need developed for a common memory device driver to use the RAM (and for applications written for the device driver). Remember, MS-DOS can only address, or see, 1 MB (1024K) of RAM. This is why the HIMEM.SYS driver file was developed. This *high memory driver* (also known as *extended memory,* or *XMS*) allows large programs such as Windows to use all of the memory that your PC's processor can address. Without it, your PC can't access any memory above 1 MB. But DOS applications still had the 640K barrier, and newer hardware accessories only exacerbated the problem.

In our PC-as-house scenario, the HIMEM.SYS acts as a ladder to access higher floors (memory areas) in the home so that larger applications, games included, can keep their extra baggage (managers, lawyers, agents, and their video/audio production equipment) behind the scenes.

Loading the HIMEM.SYS driver allows large games to use the extended memory area, the area above 1 MB.





HIMEM.SYS also allows MS-DOS to load into the extended memory area. Normally, DOS resides in conventional memory and takes up about 50K. As long as the HIMEM.SYS program is loaded in your CONFIG.SYS file (preferably as the first line in the file), you should have a line below it that states DOS=HIGH. This will load DOS (most of it) into extended memory, freeing up the conventional memory area.

Device drivers were written to handle the hardware accessories appearing on the market for mice, sound cards, and disk cache programs. This was the beginning of the conventional memory squeeze.

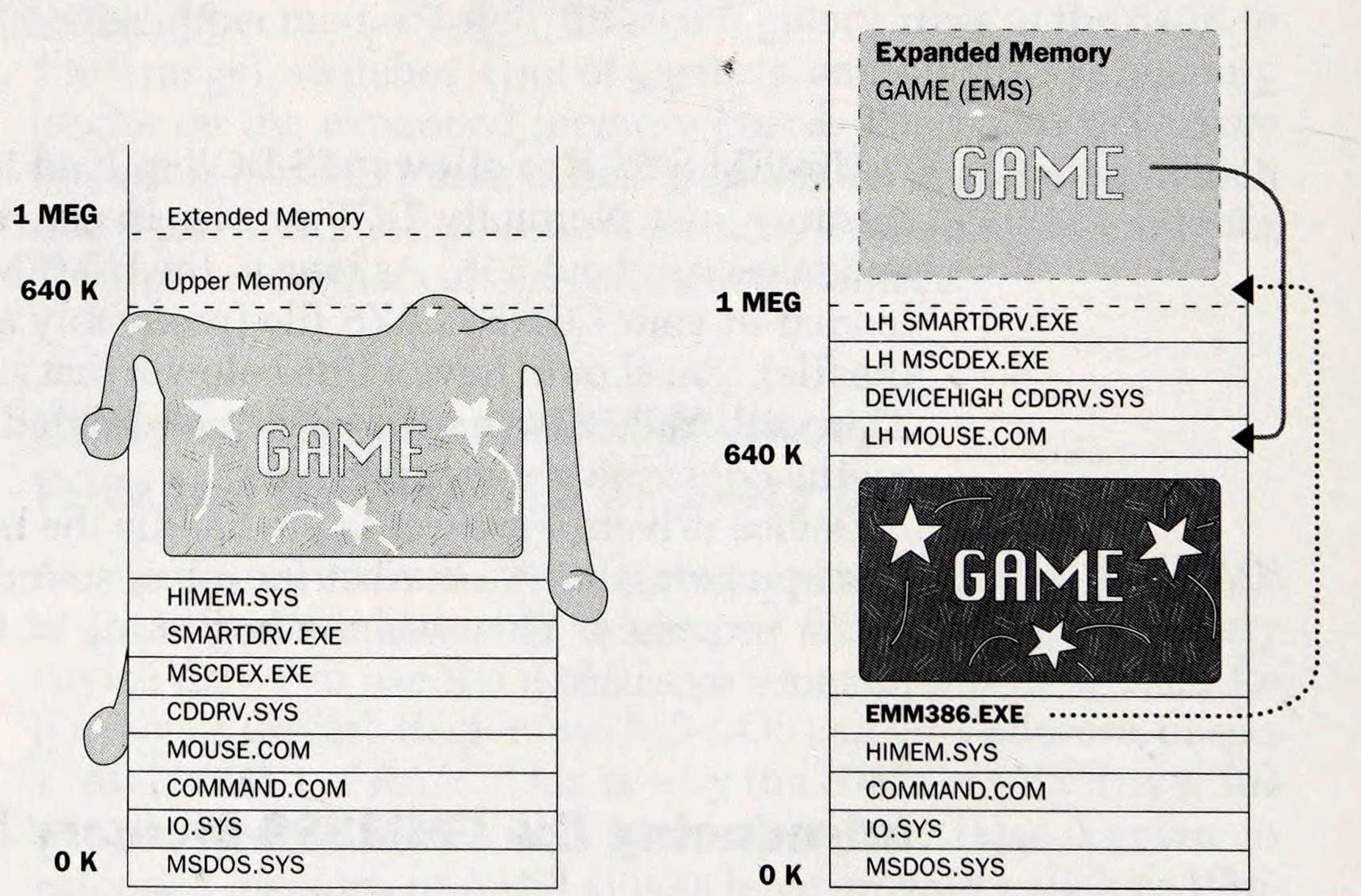
Introducing the EMM386 Memory Manager

The excess demand on conventional memory caused programs to have trouble loading or locking up afterward. When 386 computers were released, a new type of memory manager device driver was written for it that could utilize some of the free memory blocks in the upper memory area. The most popular upper device driver is the EMM386.EXE, which is included with DOS version 5 (and higher) and Windows 3.0 and higher.

CAUTION

You *must* include a command line for the HIMEM.SYS device driver in your CONFIG.SYS file *before* the device command for EMM386.EXE.

If you have a 386 (or higher) processor in your PC, you can load small programs and device drivers into the upper memory area, which will free up the conventional memory area. The EMM386 driver also allows another clever innovation: You can use the high memory on your PC (the memory available above 1 MB) to act as expanded memory for applications that demand it. The following illustration shows how this fits into the PC-as-house analogy. The EMM386 driver acts as a spiral staircase from the living room floor area to the balcony so that device drivers can reside there.



Loading the upper memory driver (EMM386.EXE) allows device drivers and TSRs to move into the upper memory area, freeing up conventional memory space for large games to load.

NOTE

The following memory optimizing tips are for users of DOS 6.2 with *no other* commercial memory management software installed (e.g., 386MAX or QEMM). If you are using another memory manager program, follow the suggestions in the manual or call the technical support line.

When using either the RAM or NOEMS switches, you *must* include the DOS=HIGH command in your CONFIG.SYS file. A DOS=UMB statement allows usage of the upper memory area for small programs and device drivers. You can combine the DOS=HIGH and DOS=UMB statements as DOS=HIGH,UMB. The device command for EMM386.EXE must *precede* any DEVICEHIGH commands.

For example, to start EMM386 as an expanded-memory emulator, using the default values, the following lines should appear in your CONFIG.SYS file:

```
DEVICE=C:\DOS\HIMEM.SYS
DEVICE=C:\DOS\EMM386.EXE RAM
DOS=HIGH,UMB
```

Keep in mind that your particular EMM386 line may have other information at the end of the line (such as I=B000-BCFF or X=C901). These are called **I**nclusion and e**X**clusion statements. They tell the driver to include or exclude certain areas of upper memory.

Do not alter any of this information when editing the EMM386 driver line.

To provide expanded memory for programs (and games) that need it, the EMM386 memory manager has to reserve a block of 64K of upper memory *at all times*. This can prevent other programs or device drivers from using this upper memory block space.

This is a typical EMM386 driver line in the CONFIG.SYS file:

```
DEVICE=C:\DOS\EMM386.EXE NOEMS
```

The line shows which directory the file is in, and NOEMS specifies that *no EMS* (expanded memory support) is needed. If expanded memory is necessary, a typical line will appear as follows:

```
DEVICE=C:\DOS\EMM386.EXE RAM
```

In this case, the line ends with a RAM designation that will provide EMS (expanded memory support for programs that require it). Using our PC-as-house analogy again, the RAM designation to the EMM386 driver would be like extending the spiral staircase from the upper memory area all the way up to the higher floors.

How to Load Device Drivers in Upper Memory

The first step to enlarge the conventional memory area (from 0 to 640K) is to eliminate any unnecessary programs and device drivers that are loading from the CONFIG.SYS and AUTOEXEC.BAT files. Some programs you can probably do without are: DOSKEY, SETVER, ANSI.SYS, RAMDRIVE, and VSAVE. There may be other lines in your particular system files, but you'll have to identify all of them first and then decide what you can do without.

Next, for your games, you must load as many device drivers as you can into unused areas of upper memory (from 640K to 1 MB). DOS 6.2 provides two methods to load high memory:

- You can run the MemMaker utility program (see your DOS manual for an overview and read the next section for more information on running MemMaker).
- You can make minor additions to the lines in the CONFIG.SYS and AUTOEXEC.BAT files to make DOS load the programs into the upper memory area.

The act of loading device driver programs into the upper memory area is called *loading high*. "High" should be thought of as higher up in the memory area than the conventional memory area. Loading high can be thought of as giving device drivers that are presently on the conventional memory floor a ticket to take the spiral staircase up to the balcony area. This shouldn't be confused with the HIMEM.SYS driver, which makes extended memory available above 1 MB.

You can manually load programs into the upper memory area by editing their line statements in the CONFIG.SYS and AUTOEXEC.BAT files. For program statements in the CONFIG.SYS file that begin with DEVICE, simply make it read DEVICEHIGH. For example, the line

```
DEVICE=C:\WINDOWS\MOUSE.SYS
```

would be changed to

```
DEVICEHIGH=C:\WINDOWS\MOUSE.SYS
```

For programs that are in the AUTOEXEC.BAT file, simply add the LOADHIGH command (or LH) at the beginning of the line. For example, the line

```
C:\WINDOWS\MOUSE
```

would be changed to

```
LH C:\WINDOWS\MOUSE
```

How the SmartDrive Disk Cache Program Affects Available Memory

With DOS 6.2, the EMM386 memory manager can provide expanded memory (EMS) to games that require it—as much RAM as there is installed. Remember, it can use any of the extended memory available (provided by the HIMEM.SYS driver), which is any memory above 1MB. For example, a computer with 4 MB of memory installed can have up to 3 MB of expanded memory made available by the EMM386 driver. However, the SmartDrive disk cache program (which comes with MS-DOS and Windows) can limit your available memory.

The SmartDrive disk cache allows your PC to store information in memory that your hard disk has to retrieve repeatedly. Think of your hard drive space as guest rooms in the PC house where your applications and games reside until they're ready to perform. If your live band (the game program) is performing in the living room and needs refreshments, various instruments, and other necessities, the SmartDrive would be considered a very bright errand boy that travels between the PC house and guest rooms to supply their needs. He stores some of the items needed in the living room so that when he gets another request, he can check for the items already in the living room instead of making another trip to a guest room.

When your hard disk searches for information, it stores a copy of the files retrieved in the memory area set aside by SmartDrive. If the PC needs the same information again, it first checks the memory area to see if the data is there. If it is, the PC retrieves it from memory instead of having the hard disk search for it (PC memory is *much* faster than the hard drive).

This Smartdrive system works well to speed up access to disk information, but it can prevent you from loading some games that need large amounts of expanded memory available. This is a typical SmartDrive program line in the AUTOEXEC.BAT file:

```
C:\DOS\SMARTDRV.EXE 1024 256
```

The beginning of the line displays the directory and filename of the SmartDrive cache, SMARTDRV.EXE. The numbers at the end of the line indicate the size, in kilobytes, of the memory to reserve for disk caching. In this example, the SmartDrive program will reserve 1024K bytes (1 MB) for DOS programs, and Windows can *reduce* the amount of the SmartDrive cache memory to as low as 256K bytes (one-quarter MB). At times Windows may need more memory available, and it may reduce the SmartDrive cache amount accordingly. Similarly, some of your games (especially the Flight Trainer types) may need over 2 MB of expanded memory available to load. If your SmartDrive program is reserving 1 MB (or more) for the disk cache, your available EMS will be under 2 MB (on a PC with 4 MB of RAM installed).

To see how your PC is loading programs, device drivers, and games in memory, type **MEM/C** at the DOS prompt. A listing of all the programs loaded in conventional and upper memory will be displayed. You'll also see how much memory is available in both memory areas.

If your AUTOEXEC.BAT file has a SmartDrive line in it, there are four ways you can make more expanded memory available for games that need it:

- You can manually edit the SmartDrive line and reduce its memory size for all sessions.
- You can bypass processing the SmartDrive line at bootup time by holding down the F8 key when **Starting MS-DOS** appears on the screen.
- You can place *two* SmartDrive lines in your AUTOEXEC.BAT file, preceding them with COMMAND/Y/C. For example:

  ```
  COMMAND/Y/C C:\DOS\SMARTDRV.EXE 1024 256
  ```

  DOS will prompt you to load either line. See the next section for selective bootup options.
- You can use the MultiConfig capability of DOS 6.2 to create various SmartDrive configurations. See the next section for information on creating multiple configuration menus.

Extra Memory Tips

To gain more conventional memory free, try the following techniques:

- Reduce the FILES statement in the CONFIG.SYS file to 30 or lower. Experiment with the number until you get an error message, and then increase the amount accordingly. By default, DOS assigns 8 file handles. Every file handle over 8 will cause DOS to reserve 39 bytes for each one.
- If you are using the SmartDrive disk cache, reduce the BUFFERS statement in the CONFIG.SYS file to 10. Each buffer number causes DOS to reserve 532 bytes.
- If you do not have a STACKS command, add one. By default, DOS will reserve 2K of memory for stacks. Make the STACKS statement in the CONFIG.SYS file STACKS=0,0. If you get a "stacks overflow" message or if any lockups occur, replace the statement with STACKS=9,256.
- To see how your PC is configuring its available memory and how it is loading programs in conventional and upper memory, type **MEM/C/P** at the DOS prompt. A listing of all loaded programs in conventional and upper memory will display. You'll also see how much memory is available as extended memory (XMS) and expanded memory (EMS).
- Check for the proper LASTDRIVE line in CONFIG.SYS. If you only have an A and a C drive, the line should be LASTDRIVE=C. Make the LASTDRIVE= statement read as the last drive in your system. Each additional drive beyond the actual drives installed takes away 88 bytes of free conventional memory.
- Remove unnecessary files like POWER.EXE, SETVER, and DOSKEY from the CONFIG.SYS and AUTOEXEC.BAT files. If you are not using DoubleSpace, eliminate DBLSPACE.BIN from the root directory (C:\).
- If you do not have a line in the CONFIG.SYS file that reads FCBS=1, add one. This can increase your free conventional memory by a few bytes.
- You can gain a little more free memory by lowering the sector buffers reserved for your CD-ROM cache. At the end of the MSCDEX file line in the AUTOEXEC.BAT file, you'll usually have an M:*xx* designator. You can make *xx* as low as 2 or as high as 64. Each number reserves 2K of memory.

After you change the number, check the free memory available with the MEM/C/P command.

- To see the location and size of free areas of conventional and upper memory, type **MEM/F** at the DOS prompt.
- If, after running the DoubleSpace utility, your conventional memory available is reduced by about 50K, you can load the DoubleSpace program (DBLSPACE.BIN) into the upper memory area by adding the following line to the CONFIG.SYS file:

```
DEVICE=C:\DOS\DBLSPACE.SYS /MOVE
```

After adding the line, saving the file, and rebooting, check the memory available by typing **MEM/C** at the DOS prompt. If there was no difference, try placing the line in different locations in the CONFIG.SYS file.

- If you are running the DOS 6.2 DoubleSpace compression program, you can add this line to the CONFIG.SYS file to gain 5K of conventional memory:

```
DBLSPACE /AUTOMOUNT=0
```

You will have to manually mount compressed floppy disks with the DBLSPACE /MOUNT A: command if you make this change.

- Placing all of the SET environment variables near the end of the AUTOEXEC.BAT file will save memory. Remember, the PATH and TEMP commands are environment variables.
- If a game displays a message like "insufficient DPMI memory" after loading, you must supply expanded memory by adding RAM to the end of the EMM386.EXE statement. If you are already supplying expanded memory, bypass using SmartDrive from the AUTOEXEC.BAT file to give it the maximum amount of EMS (expanded memory) available.
- If a game blacks out, locks up, or acts mysteriously, supply EMS to the PC and reload the game. I've found that a few games need expanded memory to run—although they make no mention of this crucial requirement in their manuals!

- *For advanced users*: To gain more memory when using the RAM statement in the EMM386 line in CONFIG.SYS, use the Microsoft Diagnostics (MSD) utility to find other unused upper memory blocks. Type **MSD** at the DOS prompt to launch MSD. If you find a 64K or larger upper memory area, you can make the EMM386 driver use this area to provide expanded memory by writing down the starting address of the free memory area. For example, if address E0000 to EFFFF is unused, add FRAME=E000 to the end of the EMM386 line. (e.g., DEVICE=C:\DOS\EMM386.EXE RAM FRAME=EOOO). NOTE: You need only the first four digits of the memory area address.

- *For advanced users:* Conventional memory may also be freed by including the monochrome range (B000-B7FF) on the EMM386.EXE line in CONFIG.SYS. (This range of memory may already be included.) For example:

```
DEVICE=C:\DOS\EMM386.EXE NOEMS I=B000-B7FF
```

- If your CONFIG.SYS file has the EMM386.EXE driver with the RAM designation, you can load the MSCDEX sector buffers into the expanded memory area. This can be done by adding a /E designation at the end of the device driver line. With this configuration, you can free up more conventional or upper memory space, depending on how the MSCDEX driver is presently loaded.

  For example, if the MSCDEX driver is loaded high with the LH designation in the AUTOEXEC.BAT file, the driver will be loaded into the upper memory area. The file size in memory will vary. The file size depends on how many sector buffers are loaded with the M:*xx* designation. Sector buffers are used like a disk cache to hold frequently used data for faster access. The minimum M:*xx* designation you can use is 2. The default is 6. The maximum you can use is 64. Each additional number over 2 uses 2K of memory.

  When you place the /E designation at the end of the line, only 16K of upper memory will be used to load the MSCDEX driver. The sector buffers will load into expanded memory. Since DOS 6.2 provides extended memory to be used as expanded memory, the sector buffers are actually being loaded into extended memory—the memory area above 1MB.

- If your CONFIG.SYS file has the EMM386.EXE file supplying expanded memory (with the RAM statement on the same line), you can load the sector buffers for the MSCDEX.EXE CD-ROM program in extended memory. Remember, with the RAM statement, the extended memory area is substituting for expanded memory. The following line will load the CD-ROM sectors into extended memory, thus freeing up upper and conventional memory:

```
LH C:\DOS\MSCDEX.EXE /D:MSCD0001 /M:30 /E
```

- If the CD ROM drive cannot be accessed from Windows and performing a DIR command gives the error message **EMM no longer valid, CDR 102**, check the MSCDEX.EXE file line in the AUTOEXEC.BAT file. If the line has /E in it, remove the /E off the end of the line, save the file, and reboot the computer. Loading the MSCDEX into conventional memory will also solve this problem.
- If your AUTOEXEC.BAT file has a SmartDrive line and your EMM386 memory manager has a RAM statement at the end of its line, the MEM/C/P command will display how much expanded memory is available *minus* the SmartDrive number reserved. The fastest way to see the EMS amount increase is to reboot the computer and hold down the F8 key at startup time, bypassing the processing of the SmartDrive line in the AUTOEXEC.BAT file. Then type **MEM/C/P** at the DOS prompt to see the difference.
- If you desire, edit the SmartDrive line memory reserve number low enough to allow your games to load. If you need to reduce the number under 512K bytes, I would recommend leaving the SmartDrive statement as it is and just bypassing the line at bootup time.

Memory Usage of the DOS Mouse Drivers: MOUSE.SYS and MOUSE.COM

For many PC games, you do not need a mouse device driver loaded in memory. If your CONFIG.SYS or AUTOEXEC.BAT file has a mouse line, you may want to reconsider loading it. For games that run in Windows or with a joystick, no mouse

driver is necessary. The following tips give you options to consider about where to load your DOS mouse driver. See the "Pointing Device Issues" section for more details.

- The MOUSE.SYS and MOUSE.COM files both perform the same function and use about 17K of memory. Both of them can be loaded into upper memory with a DEVICEHIGH or LH command.
- MOUSE.SYS loads in the CONFIG.SYS file before other drivers do.
- MOUSE.COM can be loaded from the DOS prompt or from the AUTOEXEC.BAT file. It can also be removed from memory; type **Mouse OFF** at the DOS prompt.

Running the MemMaker Utility

It can be advantageous to use an automatic memory manager program to optimize your PC's memory. It can check your computer memory and load all of the device drivers and other small programs into the upper memory area without your having to know the technical details about your PC. DOS 6.2 comes with a MemMaker program that can perform these tasks, but you may be interested in using a commercial memory manager's program.

Commercial memory management software can automate the memory usage of your PC and attain the absolute maximum amount of available conventional memory. But there are some disadvantages to using them.

First, you must compare them, shop for them, purchase them, and then install them. There are updated versions that also must be shopped for, purchased, and installed. All that time and money spent could be spent playing your games!

Second, commercial memory manager programs occasionally work too well. They invoke complex memory-swapping techniques, using extended memory to backfill and substitute for conventional and upper memory areas. While this can maximize available memory, some program applications and device drivers will not work properly under these conditions. They want to load in real memory.

Finally, commercial memory manager programs install their own device drivers to access and manage the extended and upper memory areas during installation. They are used in place of the DOS 6.2 HIMEM.SYS and EMM386.EXE drivers. In fact, your CONFIG.SYS and AUTOEXEC.BAT files will probably be nearly twice as large after you install a commercial memory manager! If you have problems with a software program and need to obtain technical support, the software technicians will ask you about any other utilities that are running on your system. If they discover you are using a commercial memory manager program, they'll probably suspend troubleshooting and ask you to uninstall the program or to obtain support from *its* tech support line.

After using a computer for a length of time, most users slowly but surely learn about PC memory issues. With a little time spent reading the DOS manual, virtually anyone can use the internal capabilities of DOS 6.2 to make minor changes to the CONFIG.SYS and AUTOEXEC.BAT files to make more memory available for programs, or you can use its automatic MemMaker utility. I believe it's better to know how your PC memory is being configured and what a game needs and then supply those needs either manually or with the MultiConfig menu system.

I've optimized memory with the MemMaker utility on a multitude of PC-compatibles with no problem. A default installation of MemMaker will not free up as much memory as a commercial memory manager, but there are some post-MemMaker tips provided in the following section that will allow you to further optimize your PC. Using these suggestions, you can nearly match the results of a commercial memory manager—without the disadvantages.

The following sections will guide you through a MemMaker installation procedure step by step. Both the Express Setup and Custom Setup methods will be shown, including the answers you should give at the screen prompts.

You'll also learn how to recover from post-installation mishaps and how to reverse the effects of MemMaker. I'll give you tips on how to test software programs and device drivers for proper operation and how to make minor changes (if necessary) to the CONFIG.SYS and AUTOEXEC.BAT files for compatibility.

Finally, you'll discover undocumented secrets of gaining more free conventional memory after MemMaker has run.

Take the precautions in the "Before You Begin" section and then read this chapter completely *before* you run MemMaker.

Starting the MemMaker Utility

Before running the MemMaker utility, backup your CONFIG.SYS and AUTOEXEC.BAT files and print them out for reference. This way you can easily compare the original settings to the new versions that will be created by MemMaker.

MemMaker will back up and rename your CONFIG.SYS and AUTOEXEC.BAT files before it runs. You'll find them in your DOS directory on your hard disk entitled CONFIG.UMB and AUTOEXEC.UMB. You should always have a copy of the original files, because if you run MemMaker again (after installing another device driver or when using the MultiConfig utility), it will copy and rename the *post*-MemMaker versions of those files in the DOS directory.

MemMaker is easy to run. Simply exit any program you're running (including Windows) and type **MEMMAKER** at the DOS prompt. The opening MemMaker screen will appear, welcoming you to the program. The following script messages are a synopsis of the MemMaker screen prompts.

Welcome to MemMaker
A brief explanation of the program and its functions are given. You are then prompted to hit Enter to continue , F2 for help or F3 to exit. Tapping on the Spacebar will cycle you through any alternate selections that are presently highlighted. At this point, CONTINUE will be highlighted.
Hit the Enter key and you'll see:

```
There are two ways to run MemMaker:
Express Setup      Automatic operation
Custom Setup       Gives more control over changes made
Use Express Or Custom Setup?
```

In most instances, you can use Express Setup. If you have a device driver or program that you do not want affected by

MemMaker, choose Custom Setup. If a problem occurs after running Express Setup, you can perform the MemMaker/Undo command at the DOS prompt to reverse the effects of MemMaker. Then you can run Custom Setup to have MemMaker bypass particular lines in your system files.

Express Setup will be highlighted. Hitting Enter will display:

```
Do you use programs that need expanded memory (EMS)?
```

No will be highlighted. You could hit the Spacebar and change the choice to Yes at this point to provide for expanded memory. Make your selection and then hit Enter. Next, you'll see:

```
MemMaker will now restart your computer
Remove any disks from your floppy drives drives and
press ENTER.
Your computer will restart.
```

Simply check your disk drives and then hit Enter. The PC will reboot and you'll see:

```
Your computer has just restarted with its new con-
figuration.
```

If your system is running properly, choose Yes. If you noticed any unusual messages when your computer started, or if it isn't working properly, choose No.

Remove any disks from your floppy drives drives and press Enter. Your computer will restart.

Check your disk drives and hit Enter. The computer will reboot and you'll see one of two messages. One possibility is this message:

```
MemMaker has optimized your system
```

To restart your computer with your original memory configuration, press Enter. To accept the new configuration, press F3.

You'll see how your memory was optimized with a Before and After chart. You can then use this optimized configuration or have MemMaker restart the PC with the original configuration. The other message you may see is this:

```
Your system was optimally configured before you ran
MemMaker. You might be able to free more conventional
memory by fine-tuning your configuration.
```

To restart your computer with your original memory configuration, press Enter. To accept the new configuration, press F3.

In this case, MemMaker couldn't make any changes that would make any difference to the system.

Assuming MemMaker made more conventional memory free, it will be a good time to view and print out the rewritten CONFIG.SYS and AUTOEXEC.BAT files.

To view and print them, type **CD/** at the DOS prompt to go to the root directory.

Then type **COPY CONFIG.SYS >PRN** to print the file. Type **COPY AUTOEXEC.BAT >PRN** to print the second file.

You can compare the changes made to the original system files and make a note of them for reference.

Recovering from Post-MemMaker Problems

If you discover that some program or hardware device fails to run properly after MemMaker has run, you have two options to correct the problem: You can have MemMaker reverse the changes it made to your system files; or you can isolate the line(s) that control the device (or that affect the operation of the program) in the CONFIG.SYS and/or AUTOEXEC.BAT files and edit them to a pre-MemMaker format.

Your first option is to have MemMaker undo the changes automatically. If you want to quickly return to your pre-MemMaker configuration, at the DOS prompt type **MEMMAKER/UNDO**. A MemMaker screen will appear that states:

```
You have specified that you want to undo the changes
that MemMaker made to your system files. To restore
your original files now, press ENTER.
To cancel, press ESC.
```

Press Enter to continue and you will see this screen:

```
MemMaker has finished restoring your original
CONFIG.SYS and AUTOEXEC.BAT files (and, if necessary,
your Windows SYSTEM.INI file)
To restart your computer with its original memory
configuration, remove any disks from your floppy disk
drives and then press ENTER
```

To keep the advantages that MemMaker made to your system files and yet clear up a problem with one file or driver, you have to isolate and identify which line in your system files is causing the problem. The easiest way to find the problem is to

boot up with the F8 selective startup method. Bypass a few lines at a time until you close in on the problem line. Keep in mind that you probably always have to load the extended memory driver—HIMEM.SYS—and you should add DOS=HIGH,UMB too (they aren't changed by the MemMaker program).

Once you determine the line or lines that cause a problem, simply edit them to appear as they do in the original version of the file.

For example, perhaps you had this line in your CONFIG.SYS before you ran MemMaker:

```
DEVICE=C:\DOS\EMM386.EXE I=B000-B7FF NOEMS D=32 X=C901
```

and after running MemMaker, it now appears like this:

```
DEVICE=C:\DOS\EMM386.EXE NOEMS HIGHSCAN
```

The HIGHSCAN statement makes MemMaker load drivers into a region of upper memory that may cause problems with video display drivers. In the original line, the statement D=32 increases the DMA buffer size to 32 (the default is 16). The X=C901 statement is an e**X**clusion that is needed so that another program will not occupy a memory block that the video driver needs to use. When these statements were removed by MemMaker (in this example only), the PC could not run Windows properly.

To correct this particular problem, edit the line to remove the HIGHSCAN statement and replace the missing I=B000-B7FF and D=32 X=C901.

Here is another line change example. Suppose you had a line in your CONFIG.SYS before you ran MemMaker that looked like this:

```
DEVICE=C:\DOS\DBLSPACE.SYS /MOVE
```

and after running MemMaker, it now appears like this:

```
DEVICEHIGH= /L:2,39345=C:\DOS\DBLSPACE.SYS /MOVE
```

Simply edit the line back to its normal line statement.

Another program to watch for is the SHARE.EXE file line. If it is altered after MemMaker, be sure to check *all* of your software applications (especially Windows programs). If strange things happen with your applications, edit the line back to its original appearance.

Running the MemMaker Custom Setup

MemMaker's Custom Setup allows you to specify what programs or device drivers to exclude from being optimized. It also gives you a chance to gain more upper memory block space by requesting a more aggressive scan of the upper memory area.

To start MemMaker, type **MEMMAKER** at the DOS prompt. The opening MemMaker screen will appear, welcoming you to the program. The following script messages are a synopsis of the MemMaker screen prompts.

Welcome to MemMaker A brief explanation of the program and its functions are given. You are then prompted to hit Enter to continue, F2 for help or F3 to exit. Tapping on the Spacebar will cycle you through any alternate selections that are presently highlighted. At this point, CONTINUE will be highlighted. Hit the Enter key and you'll see:

```
There are two ways to run MemMaker:
Express Setup     Automatic operation
Custom Setup      Gives more control over changes made
Use Express Or Custom Setup?
```

Express Setup will be highlighted. Hit the Spacebar to change the selection to Custom Setup. Then hit Enter. The next screen will display:

```
Do you use programs that need expanded memory (EMS)?
```

No will be highlighted. You could hit the Spacebar and change the choice to Yes at this point to provide for expanded memory. Make your selection and then hit Enter. Next, you'll see:

```
Specify which drivers and TSRs to include during
optimization?
```

At this stage, you can answer Yes to exclude a particular device driver you've identified.

```
Scan the upper memory area aggressively?
```

This section will be hit or miss. That is, on some systems if you answer Yes and allow MemMaker to make its changes, your system may lock up. You'll have to shut down your system and leave it off for at least a minute and then reboot. Then run MemMaker again and answer No to this selection. On other systems, there may be no problem and you could even gain another 32K of upper memory.

Optimize upper memory for use with Windows?

This is another experimental choice to make. Different models of PCs have different areas of upper memory free. Briefly stated, choosing Yes to optimize for Windows may reduce free conventional memory space, because Windows will reserve upper memory blocks for its environment. But if you run Windows (and run DOS programs in Windows), you may be able to obtain a slightly better memory configuration. The test will be to run MemMaker Custom Setup and choose Yes at this selection. When the optimization is complete, type **MEM/C/P** (to see the memory listing **c**larified one **p**age at a time) and note the conventional and upper memory areas free. Then run MemMaker Custom Setup again, choose No, and check the memory amounts again. Compare the results and decide which selection to keep.

Use monochrome region (B000-B7FF) for running programs?

You can gain another 32K of upper memory space if you do not have a monochrome monitor connected to your PC. This will work if you use a regular VGA display monitor. If you have a Super VGA display, you'll have to try it and see. Check your Windows programs for proper operation (if installed). If any problems occur, rerun MemMaker and choose No at this selection.

Keep current EMM386 memory exclusions?

If your EMM386 line (in the CONFIG.SYS file) contains a statement like X=C901, this is called an e**X**clusion. It is there to exclude certain upper memory areas from use by other programs. You can have MemMaker keep the e**X**clusion by answering Yes to this selection. If you answer No, MemMaker will try to use most of the upper memory areas that it finds available, and your PC may have a problem later. Later, test all of your DOS and Windows software for proper operation. If you do not know what the e**X**clusion is for, check with your PC manufacturer.

Move extended BIOS data area from conventional memory?

Answering Yes will move part of the BIOS (basic input/output system) data into the upper memory area. This may result in video problems or system lockups on some systems. The only way to check this is to answer Yes and test accordingly. If you do experience problems, run MemMaker Custom Setup again and answer No to this question.

Optimizing Memory After Running MemMaker

This section is for *advanced users* who are familiar with PC memory structure and who've backed up their system files.

The MemMaker utility program will do a good job of checking your system's memory usage and automatically loading your device drivers into the best possible upper memory locations. But it has its limits. There are two small tasks it will not do that you can perform yourself to free more conventional memory.

First, MemMaker is not as aggressive in scanning every possible upper memory location that you can use to store a device driver into. By viewing the memory map shown in the Microsoft Diagnostics (MSD) program (type **MSD** Enter at the DOS prompt and then type **M** for memory). All of the black boxed FFs represent free upper memory blocks. Check the areas that are free from bottom to top. For instance, if the area from C800 to CFFF is free, you could add a statement at the end of the EMM386 line to include this area on the line, make it appear like this:

```
DEVICE=C:\DOS\EMM386.EXE RAM I=C800-CFFF
```

Second, unlike commercial memory management programs, MemMaker will not change the loading order of items listed in the CONFIG.SYS or AUTOEXEC.BAT files. By using the Microsoft Diagnostics (MSD) program and studying the undocumented MEMMAKER.STS file (stored in your DOS directory), you can probably locate and use more upper memory areas for storing device drivers.

We'll see why the loading order of device drivers is important. When MemMaker configured your system, it created a log of the software drivers and programs to optimize from the information in your CONFIG.SYS and AUTOEXEC.BAT files. The log file is called MEMMAKER.STS. There are two ways to view the MemMaker Status file. The first way is to use the MSD program to view the file. After starting the Microsoft Diagnostics program (type **MSD** at the DOS prompt), you can pull down the File menu and choose MEMMAKER.STS.

The MEMMAKER.STS file can also be viewed from a word processor program. At the DOS prompt, type **EDIT C:\DOS\MEMMAKER.STS**. The DOS EDIT program will display the file

on your screen for viewing and printing. Print a copy for reference. A typical listing of a MEMMAKER.STS file is shown here:

```
[MemmakerData]
State=UNDO/DONE 5550
AvailConvMemoryBefore=631136
AvailUpperMemoryBefore=121536
UsedUpperMemoryBefore=69728
WindowsUpperMemoryBefore=0
EMSUpperMemoryBefore=0
AltSysFiles=False
WindowsXlat=False
CustomMode=True
AutoexecBatCheckSum=37577
ConfigSysCheckSum=21205
SystemIniCheckSum=0
WindowsLocation=C:\WINDOWS

[SizeData]

Command=C:\MOUSE
Line=14
FinalSize=17088
MaxSize=56944
FinalUpperSizes=0
MaxUpperSizes=0
ProgramType=PROGRAM

Command=C:\WINDOWS\IFSHLP.SYS
Line=16
FinalSize=3920
MaxSize=4560
FinalUpperSizes=0
MaxUpperSizes=0
ProgramType=DEVICE

Command=C:\DOS\DOSKEY
Line=17
FinalSize=4144
MaxSize=6384
FinalUpperSizes=0
MaxUpperSizes=0
ProgramType=PROGRAM

Command=C:\SMARTDRV.EXE 512 256
Line=15
FinalSize=0
MaxSize=44896
FinalUpperSizes=26720
```

```
MaxUpperSizes=45456
ProgramType=PROGRAM

Command=C:\DOS\SHARE.EXE
Line=19
FinalSize=16944
MaxSize=16944
FinalUpperSizes=0
MaxUpperSizes=0
ProgramType=PROGRAM
```

The first section, [MemmakerData], gives information about the PC's configuration before and after the MemMaker utility has run. The most important sections of the MEMMAKER.STS file to study are the individual Command= sections. These reference each command in the CONFIG.SYS and AUTOEXEC.BAT files that MemMaker worked with.

The first line gives the program or device driver name. The next lines display information about the loading size of the file and the final size of the file after it is installed. If you check all of the command sections, you'll notice that some programs require a larger memory area to be free while installing than they do when they are finally loaded.

Here is a partial listing for the MOUSE device driver program:

```
Command=C:\MOUSE
Line=17
FinalSize=17088
MaxSize=56944
```

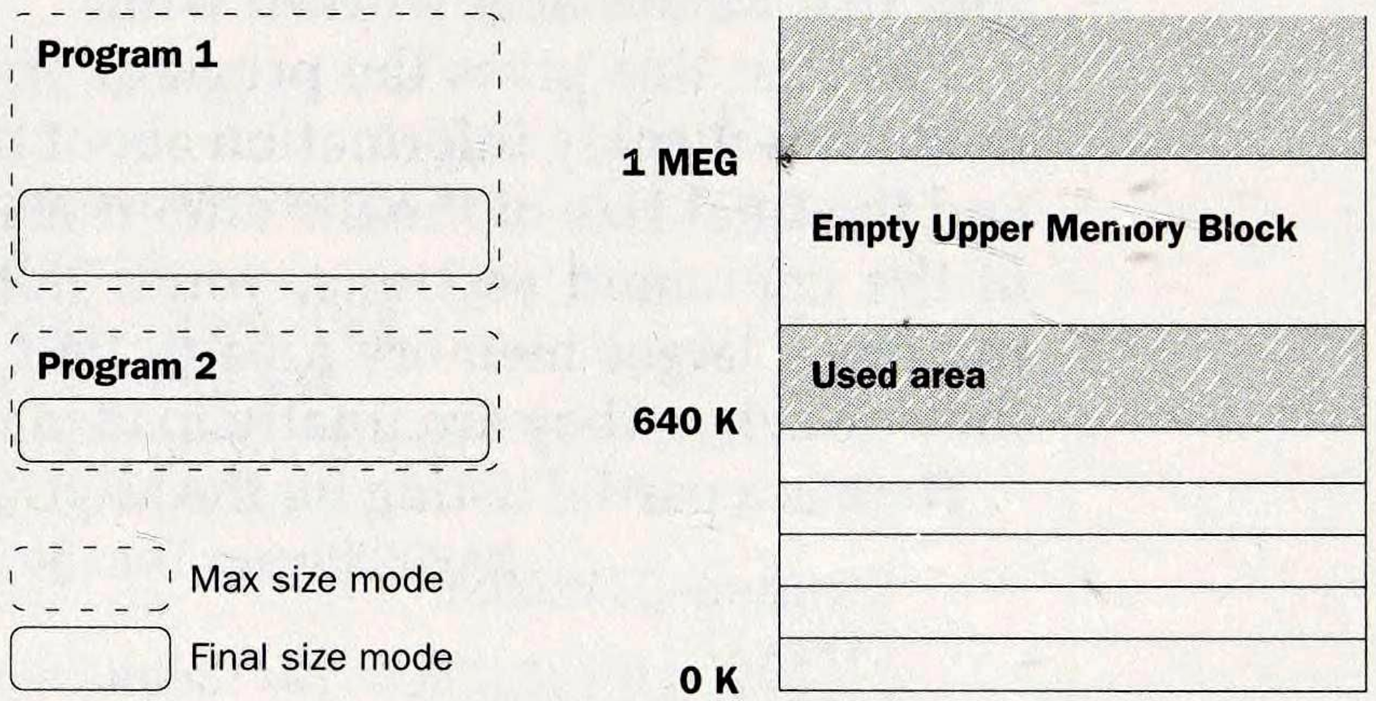
The MOUSE program's MaxSize =56944 (57K). That means it needs at least a 57K free memory area to install. Its final size after installation is only 17088 (17K)! So it takes about 60 percent less memory space when finally loaded. Some programs require virtually the same size memory area free when loading and after loading (see the C:\DOS\SHARE.EXE example above). Others programs install in as little as 15 percent of the original memory area required to load them.

When you have a guide to file-loading size versus installed size provided by the MEMMAKER.STS file, it is easy (for advanced users) to use the MEM/C/P command or the MSD program to view your PC's memory map and find more upper memory areas free. You can also change the order of some of the device driver and program lines in your system files to force certain programs to load before others do.

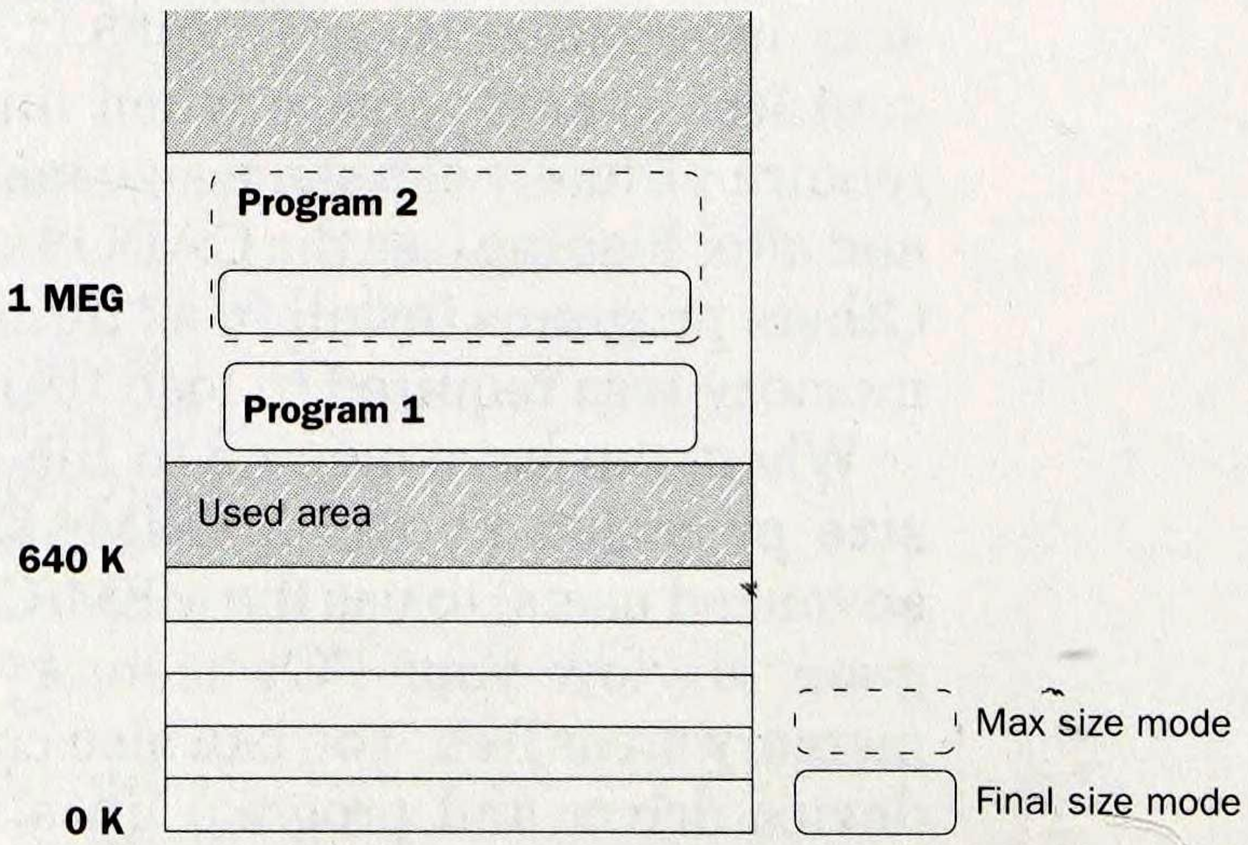
Loading order is important when you have limited upper memory block space. (Remember, CONFIG.SYS gets loaded first, then the computer loads the AUTOEXEC.BAT file.)

For example, if you only have a 60K upper memory area block free and you want to install two device driver programs there (assuming their combined final size is less than 60K), you must load the program with the biggest difference in MaxSize and FinalSize. In this manner, the program will need a large free memory area to load. Then it will shrink to its final size. The second program will have room in memory to load in the remaining space. If the smaller program was loaded first, the larger one wouldn't fit while it was in its max size. DOS would then load the program in the conventional memory area.

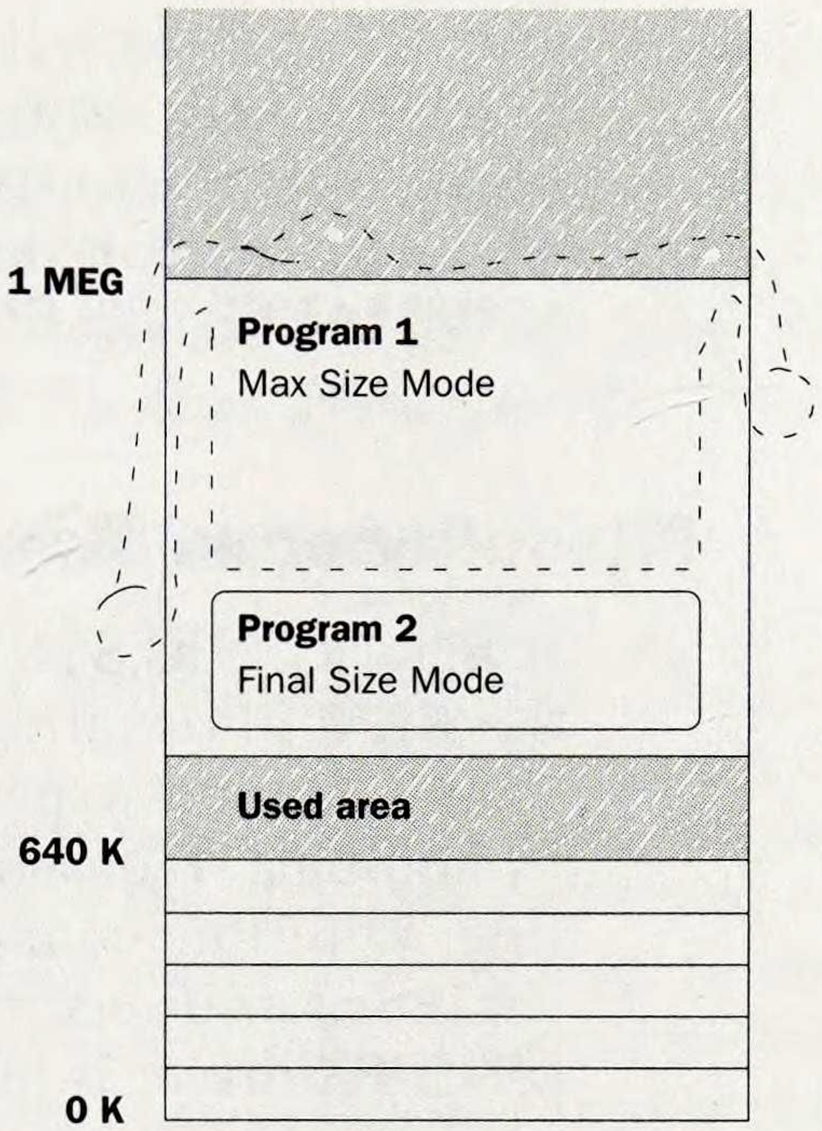
Some programs, TSRs, and device drivers are much larger while loading.



If Program 1 is loaded first, it will shrink, allowing Program 2 to fit in the upper memory block while it is in its Max Size mode.



If Program 2 is loaded first, there will not be sufficient room for Program 1 to load while it is in Max Size mode.



When altering the loading order of programs in the CONFIG.SYS and AUTOEXEC.BAT files for experimentation, keep these timesaving safety tips in mind:

- Of course, back up your original copies of the CONFIG.SYS and AUTOEXEC.BAT files.
- The following lines in the CONFIG.SYS file should always appear *first*, in this order:

```
HIMEM.SYS
EMM386
DOS=HIGH,UMB
```

- If you have a DBLSPACE.SYS/MOVE line, it should be loaded before other drivers because it requires about 50K of memory space or else it won't load high.
- If you have a CD-ROM drive and you are using the SmartDrive cache program in the AUTOEXEC.BAT file, place the MSCDEX.EXE line *above* the SMARTDRV.EXE line, or else the SmartDrive program will not cache the CD-ROM drive.
- If you are using the MultiConfig menu program, create a CONFIG.SYS file for each separate configuration. You have to rename the original CONFIG.SYS, combine the [Common]

and [MenuItem] lines into a separate file, name it CONFIG.SYS, copy it to the root directory, and run MemMaker. Then create a MultiConfig file that is optimized with the information learned from viewing the MEMMAKER.STS file.

Miscellaneous Memory Issues

- If your CONFIG.SYS file has the EMM386.EXE driver with the RAM designation, you can load the MSCDEX sector buffers into the expanded memory area. This can be done by adding a /E designation at the end of the device driver line. With this configuration, you can free up more conventional or upper memory space, depending on how the MSCDEX driver is presently loaded.

  For example, if the MSCDEX driver is loaded high with the LH designation in the AUTOEXEX.BAT file, the driver will be loaded into the upper memory area.

  By placing the /E designation at the end of the line, only 16K of upper memory will be used to load the MSCDEX driver. The sector buffers (designated with M:*xx*) will load into expanded memory. Since DOS 6 provides extended memory to be used as expanded memory, the sector buffers are actually being loaded into extended memory—the memory area above 1 MB.

- If the CD ROM cannot be accessed from Windows and doing a DIR command at the DOS prompt gives the error message **EMM no longer valid, CDR 102**, check the MSCDEX.EXE file line in the AUTOEXEC.BAT file. If the line has /E in it, remove the /E off the end of the line, save the file, and reboot the computer. Loading MSCDEX into conventional memory will also solve this problem.

- EMM386 exception errors usually occur after an upgrade version of MS-DOS is installed. The EMM386.EXE program line listed in the CONFIG.SYS file has probably been altered from its pre-installation settings. Search the hard disk or older backup files for a previous version of the system's CONFIG.SYS file and edit it.

- DPMI errors occur because some games utilize their own memory manager and don't want you to run any other memory manager program—like EMM386.EXE. In this case, you must step through your CONFIG.SYS file (using the F8 selective bootup option) and skip over the EMM386.EXE file line. Then start the game again.

Selective Startup Methods

MS-DOS 6.2 provides selective startup routines that allow you to process or bypass individual lines in the CONFIG.SYS and AUTOEXEC.BAT files. This capability is invaluable for loading games that fail because there isn't enough conventional memory free.

If you press F5 or the Shift key before you see the **Starting MS-DOS** message on your screen at startup, the PC will completely bypass the CONFIG.SYS and AUTOEXEC.BAT files.

If you press the F8 key before you see the **Starting MS-DOS** message on your screen at startup, your computer will allow you to process or bypass every single line in your CONFIG.SYS and AUTOEXEC.BAT files. To process a line, hit Y for Yes. To bypass a line, hit the N key for No.

You can use this selective step-through procedure to boot the PC without certain files loaded and check the amount of free conventional memory with the MEM command. To test the amount of memory available with different files loaded, first get a piece of paper and a pen and make a File Bypass/Memory Free log sheet, as shown here:

```
_____ File Bypass/Memory Free _____
File Bypassed _____________________________
File Bypassed _____________________________
File Bypassed _____________________________
File Bypassed _____________________________
File Bypassed _____________________________
File Bypassed _____________________________
File Bypassed _____________________________
Largest Executive Program Size = _____ K
```

Only a few lines can be bypassed from your CONFIG.SYS and AUTOEXEC.BAT files to provide more free conventional memory. For virtually all games, an extended memory manager (HIMEM.SYS) and an upper memory/expanded memory manager (EMM386.EXE) are needed. And you'll want to load MS-DOS into the high memory area (DOS-HIGH,UMB).

After bypassing certain lines, change to your MS-DOS directory and type **MEM** to find out how much conventional memory is available.

Type **CD\DOS** Enter. Then type **MEM/C/P** Enter.

The screen will display extensive information about how memory is being used in your system. A typical MEM display is shown here:

```
Memory Type          Total =  Used  +  Free
-----------          -----    ----     ----

Conventional           640K      35K     605K
Upper                  187K     187K       0K
Adapter RAM/ROM        384K     384K       0K
Extended (XMS)        2885K    1641K    1244K
-----------          -----    ----     ----

Total memory          4096K    2247K    1849K
Total under 1 MB       827K     222K     605K
Largest executable program size  605K  (619728 bytes)
Largest free upper memory block    0K    (0 bytes)
MS-DOS is resident in the high memory area.
```

The line,

```
Largest executable program size  605K  (619728 bytes)
```

indicates the amount of conventional memory free—605K.

Faster Startup Methods

Once you know which files in your CONFIG.SYS and AUTOEXEC.BAT files must be bypassed to gain more free conventional memory, you can use DOS 6.2 to provide easier bootup routines. This is much quicker and less troublesome than creating a boot diskette for all of your hard-to-load games.

Even though many game manuals suggest making a boot diskette to load the minimum files necessary to start the game, I don't recommend it. There are too many things that can go wrong in the creation process; many people accidentally edit their *hard disk's* CONFIG.SYS and AUTOEXEC.BAT files instead of the ones on the boot diskette!

The game manual that lists which files to copy on the boot disk provides you with all the information you need to step through the CONFIG.SYS and AUTOEXEC.BAT files with the F8 step-through routine. Why have a stack of disks lying around for every game when you can simply hold down the F8 key at startup time?

Other game users in the household may not remember what files to process and which to bypass in the CONFIG.SYS and AUTOEXEC.BAT files to run a particular game. This section will show you how to make the step-through process faster and friendlier.

Creating an Interactive Startup

If your games need only minor changes to the CONFIG.SYS and AUTOEXEC.BAT files, you can use the first method shown below. For example, if you need to bypass just one or two lines to gain more free conventional memory, you can add one character—a question mark—to the filename and you'll be prompted automatically to load or bypass the file(s). This method will eliminate the process of waiting until you see the **Starting MS-DOS** message, holding down the F8 key and processing *each* line in the CONFIG.SYS and AUTOEXEC.BAT files.

A sample CONFIG.SYS file is shown below. It loads files and device drivers to make extended memory, expanded memory, a mouse, and a CD-ROM drive available.

```
DEVICE=C:\DOS\HIMEM.SYS
DOS=HIGH,UMB
DEVICE=C:\DOS\EMM386.EXE RAM
FILES=30
BUFFERS=8
STACKS=9,256
DEVICE=C:\WINDOWS\MOUSE.SYS
DEVICE=C:\MMP16P\DRIVERS\CDMKE.SYS /D:MSCD0001 /P:630
```

In this example, the last two lines load a mouse driver and a driver for the CD-ROM drive. These drivers take up valuable memory and are not necessary for games that are installed on the hard disk and do not require a mouse. To have MS-DOS automatically prompt you to load these lines, just add a question mark after the word *device*, for example:

```
DEVICE?=C:\WINDOWS\MOUSE.SYS
DEVICE?=C:\MMP16P\DRIVERS\CDMKE.SYS /D:MSCD0001 /P:630
```

Another reason to add the question mark is to give you a settings choice for a particular driver. You can add a duplicate line of a device driver to the CONFIG.SYS file with an altered setting and then choose between the two drivers at startup.

For instance, if you require expanded memory available on certain sessions but not on others (to gain 64K of upper memory free), you could edit your CONFIG.SYS file to include *two* EMM386.EXE lines. For no EMS available, the first line would look like this:

```
DEVICE? =C:\DOS\EMM386.EXE NOEMS.
```

For EMS available, include the line:

```
DEVICE?=C:\DOS\EMM386.EXE RAM.
```

MS-DOS will ask you if you want to process or bypass both lines. For sessions when you need maximum conventional memory available (but no EMS memory available), you would answer **Y** for Yes on the DEVICE?=C:\DOS\EMM386.EXE NOEMS line and **N** for No on the next line. To make EMS available, you would answer **N** for No on the first line and **Y** for Yes on the next line:

You can also use the question mark inclusion in any line in the CONFIG.SYS file, including one with a DEVICEHIGH statement. This procedure will save time and prevent possible errors that can occur when you have to perform an F8 selective boot of the CONFIG.SYS.

Creating an Automatic Startup Menu

When you become familiar with *all* of the lines in your CONFIG.SYS and AUTOEXEC.BAT files that are necessary to load particular games, you can use the DOS 6.2 MultiConfig capability to create an automatic startup menu. The menu will allow your PC to boot up using customized configurations for different types of applications.

A multi-configuration menu is simple to make as long as you know what *every* line in your system files is needed for. If you haven't learned the function of every line, do so *before* you attempt to create a MultiConfig menu system. You can copy and print out your CONFIG.SYS and AUTOEXEC.BAT files and check your MS-DOS manual or your PC manufacturer's technical support department for clarification. If you have installed any extra hardware utilities that added lines to your CONFIG.SYS and AUTOEXEC.BAT files (like a sound card), you'll have to know why each one is needed and if they can be bypassed to gain more memory.

First back up and print out your CONFIG.SYS and AUTOEXEC.BAT files for reference.

To copy the files to a formatted floppy disk in the A drive, type the following at the DOS prompt **CD** Enter. Next, type **COPY CONFIG.SYS A** Enter.

Then type **COPY AUTOEXEC.BAT A** Enter.

The disk in drive A will now have a copy of your CONFIG.SYS and AUTOEXEC.BAT files saved on it. With your printer online, type **COPY CONFIG.SYS >PRN** Enter. Then type **COPY AUTOEXEC.BAT >PRN** Enter.

Now you'll have a printout of your CONFIG.SYS and AUTOEXEC.BAT files for reference. Here's a sample CONFIG.SYS file for a PC that has a sound card and a CD-ROM drive installed:

```
DEVICE=C:\DOS\HIMEM.SYS
DOS=HIGH,UMB
DEVICE=C:\DOS\EMM386.EXE RAM
FILES=30
BUFFERS=8
STACKS=9,256
DEVICE=C:\WINDOWS\MOUSE.SYS
DEVICE=C:\MMP16P\DRIVERS\CDMKE.SYS /D:MSCD0001 /P:630
```

To make a multiple-choice startup menu, you must indicate the titles you want to name the various menus, called Menuitems. For example, the CONFIG.SYS file below has two Menuitems: WINDOWS and GAMES. To alter a plain CONFIG.SYS file into an automatic menu type, simply edit the file to include your menu title names under the [MENU] section and repeat that name in the file (surrounded by brackets [*xxxx*]). Any lines under the menu title (e.g., Maximum Memory) will only be processed if you select Maximum Memory at startup.

```
DEVICE=C:\DOS\HIMEM.SYS
DOS=HIGH,UMB
DEVICE=C:\DOS\EMM386.EXE RAM
FILES=30
BUFFERS=8
STACKS=9,256
[MENU]
MENUITEM=GAMES
MENUITEM=WINDOWS
[WINDOWS]
DEVICE=C:\WINDOWS\MOUSE.SYS
DEVICE=C:\MMP16P\DRIVERS\CDMKE.SYS /D:MSCD0001 /P:630
[GAMES]
```

The items added to the sample CONFIG.SYS file are printed in bold type. Notice the similarity to the sample CONFIG.SYS. When the PC starts, it will produce the following prompt:

```
MS-DOS 6.2  Startup Menu
========================
1. WINDOWS
2. GAMES
Enter a choice: __
```

If you enter **1**, the first six lines in the CONFIG.SYS file will be processed, followed by the lines below the [WINDOWS] section. If you choose **2**, the first six lines will be processed, along with the ones below the [GAMES] section—in this example, no more lines will be processed and available memory is maximized. Pretty simple, isn't it?

Advanced Automatic Startup Menu Features

The preceding example illustrated the simplest way to create an automatic startup menu. If you want more power and flexibility, read on. You'll learn how to set the screen colors and automate the AUTOEXEC.BAT file. If you are ready for these advanced techniques, back up your hard drive's CONFIG.SYS and AUTOEXEC.BAT files before proceeding. You will need a printed copy of both files for reference as you make changes to these files.

Adding Color to the Startup Menu To set the text and background color for a startup menu, you need only add a MENUCOLOR= command line in the [Menu Item] section of the CONFIG.SYS file.

```
MENUCOLOR=x[,y]
```

sets the text and background colors for the startup menu. This command can only be used within a CONFIG.SYS menu block.

x specifies the color of the menu text. The range of specified values is from 0 to 15. *y* specifies the color of the screen background. The range of specified values is from 0 to 15.

Color Values

0. Black
1. Blue
2. Green
3. Cyan
4. Red
5. Magenta
6. Brown
7. White
8. Gray
9. Bright Blue
10. Bright Green
11. Bright Cyan
12. Bright Red
13. Bright Magenta
14. Yellow
15. Bright White

For example, the following MENUCOLOR command sets the menu text to bright white and the screen background to blue:
MENUCOLOR=15,1

On some video monitors, the colors 8 through 15 will blink.

To learn about more about the MultiConfig function, type **HELP MULTI-CONFIG** at the DOS prompt.

Creating a Smart AUTOEXEC.BAT

The GOTO command directs MS-DOS to process a series of lines within a batch program identified by a label. When MS-DOS finds the label, it processes the commands beginning on the next line.

When you create a MultiConfig type of CONFIG.SYS file, The [Common] and [MenuItem] parameters set an environment variable named CONFIG. Using the GOTO command in the AUTOEXEC.BAT file allows it to carry out different sets of commands for different CONFIG values.

After you've created a MultiConfig file, with [GAMES] and [WINDOWS] MenuItems parameters, it is easy to make an AUTOEXEC.BAT file that will load the proper files in accordance with your instructions. For example, here is a typical AUTOEXEC.BAT file:

```
@ECHO OFF
PROMPT $P$G
PATH=C:\WINDOWS;C:\DOS;C:\GAMES
C:\DOS\SMARTDRV.EXE  1024 512
WIN /3
```

To make this AUTOEXEC.BAT file load certain lines *only* when the [GAMES] or [WINDOWS] menu is selected, you could alter it to look like this:

```
@ECHO OFF
PROMPT $P$G
GOTO %CONFIG%
:GAMES
PATH=C:\GAMES;C:DOS;C:\WINDOWS
C:\DOS\SMARTDRV.EXE  256 256
LH C:\WINDOWS\MOUSE
GOTO END
:WINDOWS
PATH=C:\WINDOWS;C:\DOS;
C:\DOS\SMARTDRV.EXE  1024 512
WIN/3
GOTO END
:END
```

Notice that the only additions to the file are the GOTO %CONFIG%, :GAMES, and :WINDOWS lines. The GOTO %CONFIG% line makes the AUTOEXEC.BAT look for the environment variable set in CONFIG.SYS. If the [GAMES] selection was selected at bootup, the DOS would go to the :GAMES line in this file and process the remaining lines until the GOTO END line. It would then look for the :END line and finish.

Notice that the :GAMES section of AUTOEXEC.BAT is optimized to run DOS games. The PATH statement has the C:\GAME directory listed first for faster access. The SmartDrive program is only reserving 256K of memory. The mouse driver is also loaded high for the games that need it.

If the [WINDOWS] selection was chosen from the MultiConfig menu, the AUTOEXEC.BAT file would process the first two lines and then jump down to the :WINDOWS section and process the remaining lines to the end. This section is optimized for Windows because the PATH has the C:\WINDOWS directory first. SmartDrive is reserving 1024K, and no mouse driver is loading (Windows loads its own mouse driver).

Part 4

Video Issues

Games use the maximum capabilities of your video card, CPU, and video device drivers. Most game-*running* problems (as compared to game-loading problems) can be traced to a video problem. In this chapter you'll learn the basics of PC video standards and solutions to common game-running problems. First, a little background on the PC video industry evolution is necessary.

PC-Compatible Video Display Types For DOS and Windows

Video display for PC-compatibles has grown from a one-color, text-only screen to high-resolution displays with millions of colors. Color graphic standards grew from basic CGA (color graphics adapter) to EGA (enhanced graphics adapter) to the VGA standard (video graphics array). With these video card types, you didn't used to need to install video device drivers to run games. Game programs included the necessary device drivers for these video modes.

A *device driver* is a software program that communicates with and controls a hardware device, such as a video display card. Your game software works with the video driver program, which

in turn controls the output of the video card. The video card transmits the proper signals to the video monitor.

Returning to the PC-as-house analogy introduced in the last part, the video monitor can be thought of as a big-screen TV set up in the living room area for entertainment. The video driver program is the cable converter box that can allow more channels to be viewed when it is properly installed.

When PC games began to require higher resolution and colors to display fast screen redrawing (or scan rate) for smooth animation, computer makers had to develop a video mode beyond the VGA 640 × 480/16 color graphic resolution. The most popular VGA resolution was 800 × 600 pixel resolution, which soon became known as Super VGA. Every display adapter manufacturer, however, had a different idea about how to put higher resolution on the screen. Multiscanning monitors made 800 × 600 pixel and higher resolutions viewable but not entirely trouble-free.

The different standards resulted in off-center images popping up on the screen, because the timing of their signals was different. There was no standard for a scan rate or refresh rate, so a given multiscanning monitor had no assurance of working with a specific Super VGA board. The lack of standards created incorrect video images on some monitors.

In 1988, NEC (Nippon Electric Corporation) brought together many of the more prominent video board manufacturers to standardize the electrical, timing, and programming issues surrounding the 800 × 600 resolution video displays. The result was the formation of the VESA (Video Electronics Standards Association) standard. VESA went beyond the initial goal of setting a hardware standard for Super VGA signals, creating a software standard as well.

Instead of developing an iron-clad specification, VESA developed a combination of standards and guidelines that left no manufacturer in the cold, nor any single set of numbers carved in stone. The committee emphasized the need for a high 72 Hz refresh rate to minimize the screen flicker, and thereby set a standard for Super VGA. The committee also created guidelines that allowed Super VGA systems operating at 56 and 60 Hz to earn the VESA title.

Monitor Setup and Adjustment

If you are having display problems, first make sure that the hardware is okay. Check the monitor settings, including vertical height, vertical hold, brightness, contrast, and so on. When the monitor and computer are off, remove the monitor cable and look for bent pins (some may be missing, which is normal on some VGA cables). Check for any DIP switch settings on the monitor (check the manual for settings if necessary). A **D**ual **I**nline **P**osition switch allows user hardware changes.

Next, coordinate the computer's CMOS setup screen information to the monitor and program configuration. See Part 1—Before You Begin and your PC manual for CMOS setup screen tips. On most VGA-equipped PCs, the CMOS setup screen should have a line or two that states:

```
Monitor Type:  Color Non-Interlace   Video Type:  VGA/EGA
```

Some PC video cards include a special video utility program. The program can control resolution, pixel depth, refresh rate, desktop display mode, interlace/non-interlace mode, control over pan and zooming in and out of the image, and font size. If installed, refer to video card's setup program first to ensure that your PC display type and resolution are configured properly. Also, check the PC's CMOS settings to see if they match the video utility settings. Otherwise you may experience a flickering or incorrect display.

How Games Affect Video

PC games have a *very* close working relationship to the video device driver installed in Windows or DOS. Before some games will load (and sometimes before they'll install), a video driver of a minimum resolution and color level must be installed on the PC. Some games will scan the motherboard or the hard drive for the identity of the video card or VESA driver files. The game program will then "guess" the video card type and load its own video driver. Sometimes the guess is wrong and the game installs a video device driver that will result in a blacked-out or distorted screen display.

Windows video drivers also control the screen display size and speed for Windows games. Usually, the 640 × 480 with 256 colors is the optimum driver because it is the minimum resolution for most multimedia games and it produces a fast, full-screen display.

After a failed installation (when a game program deletes the files from the hard disk drive's root directory), the CMOS system settings will be lost. Any special video card CMOS settings will be erased and possibly the VESA drivers files themselves can become corrupted or erased. It's important to save backup copies of setup screen information on disk in case they need to be reinstalled.

Identifying Video Cards and Loading Video Drivers

To run PC games for Windows and DOS, you must have the *latest* video device driver files for your PC's video card. Most video display problems in games can be resolved by using the most recent video driver version.

These are some typical video problems game users encounter:

- Colors may cause the system to lock up and display poor video when starting Windows.
- Highlighting may not be correctly shown on the screen.
- There may be video "trash" in the game.
- You may see screen "trash" (often described as "flakes," "ghost images,") or discolored pixels during 256-color high-resolution graphic programs such as Windows or games.
- The colors in Windows change at random.
- When running Windows, a General Protection Fault occurs that displays the name of the display driver.

First, you'll have to identify your video card. One of the first messages displayed on the screen during bootup time is the video card manufacturer name and video card I.D. number. If your video card is built on the motherboard or was installed with the PC, you can contact the PC manufacturer for more information about the video card and device driver's availability. If you've

installed a separate video card, the manual will list the video card maker's name, address, and phone number (and possibly a BBS number). If you cannot locate the name and address of the manufacturer, check the Reference section of this book for manufacturer information.

You should also have a copy of the Windows Super VGA drivers available from the Microsoft Download Service. See Part 10 for details on downloading the latest Windows video device drivers.

What You Need to Run PC Games

Obtain all the specifications about your video card for reference so you'll know what its capabilities are. The most important spec to be aware of is the amount of video memory installed with the card. Video RAM (VRAM) controls the maximum resolution available for display. Basically, if your video card has 256K of VRAM, it can only display a screen resolution of 640 × 400 with 16 colors. If you have 512K, your highest resolution will be 1024 × 768 with 16 colors or 800 × 600 with 256 colors. With 1 megabyte (MB) of VRAM, you can display even higher resolutions and colors.

Higher resolutions are not necessarily better, though. The minimum resolution for most multimedia applications is 640 × 480 with 256 colors. This will give you the largest display at the fastest speed.

You also need to obtain the most recent updated video drivers for DOS (the VESA drivers) and for Windows. They are available on diskette, or you can download them with your modem. Make a directory on your hard disk in which to store them. If any README.TXT document file is included (or on the diskette), view it and print it from your word processor. The information can be invaluable and may save you time in loading the drivers and in troubleshooting problems. Check with the video card company or scan BBSs at least every three months to learn about newer video device drivers and known software conflicts with specific application programs and games.

Some PC video cards include an elaborate video driver configuration program that can install various device drivers. This allows you to control every aspect of the video display (for DOS and Windows). For instance, some programs allow: control of pixel depth, a virtual desktop display (where the Windows desktop, or work area, can be larger than the physical screen), keyboard control over pan and zoom in and out of the image, multiple font size, and more options. Always refer to that program first to ensure that your PC is set up properly. Also, check your monitor's specifications for resolutions supported and scan rate and confirm them with your computer's CMOS setup screen for the display and monitor type settings.

Loading VESA Video Drivers for DOS Games

Some DOS Games require a VESA video driver program to work. The driver must be loaded before you install the program; this can be done at the DOS prompt or in AUTOEXEC.BAT. You'll probably want to load the VESA driver for your video card at the DOS prompt, so that the VESA driver won't use memory when it isn't needed. In fact, a VESA driver loaded in memory can interfere with some game setup programs and produce bad displays. Check your AUTOEXEC.BAT and CONFIG.SYS files for a video driver file that may not be needed for all of your programs.

Methods for loading VESA drivers will vary. Some VESA drivers can be run in more than one mode. You'll have to experiment with different VESA modes and record your information on a video log sheet for future reference.

I've included a sample VESA driver installation routine for a Headland Technology (HT) video card as an example.

Installing the HT VESA Driver

To install the Headland Technology VESA driver from the diskette, first switch to the directory where the HTVESA.COM file is located (e.g., enter **CD\HT** at the DOS prompt).To load the VESA driver in memory, enter **HTVESA /1** or **HTVESA /2**.

To install the HT VESA video driver automatically from the AUTOEXEC.BAT file, simply add to the PATH line the name of the directory that the file resides in (e.g., PATH=C:\HT;C:\WINDOWS) and include the name of the file on a line, as in **HTVESA/1**.

Installing Window Drivers

Almost all Windows games now require high-resolution video device drivers. Windows 3.1 (and above) includes various video drivers from its setup program, but only the standard VGA (and possibly Super VGA) and specific drivers *made for your particular video card* will work with your PC's video card. The other drivers on the DISPLAY list in the Windows setup program can cause Windows not to load or to display a blacked-out screen.

You can use the Windows setup program from within Windows or at the DOS prompt. When you change video settings in Windows, you have to restart your computer before the changes will take effect. It is wise to learn how to use the DOS Windows setup program, because if something goes wrong, you'll have to use it before you can run Windows again!

To run the Windows setup program:

1. From the DOS prompt, enter **CD\WINDOWS**. Then type **SETUP**.
2. Highlight the line that shows **Display** and then press Enter. If your video drivers are already loaded in the Windows/system directory, you can use the arrow keys to scroll to the driver you want. When that driver is highlighted, hit the Enter key three times and then you'll be at the DOS prompt. Then enter **WIN** to start Windows to test the new driver.
3. If the video drivers are on a diskette, highlight **Other** and press Enter. You will be prompted to insert a manufacturer's device driver disk. Put the driver disk in drive A; then press Enter. If the files are on your hard disk, type in the directory name and then press Enter again.
4. At this point you'll see a list of installable drivers on the diskette. Highlight the video driver from the list and hit Enter. Then highlight the **Complete changes** option and hit Enter. The setup program will exit to the DOS prompt and you can enter **WIN** to start Windows to test the new driver.

Troubleshooting Video Problems in DOS and Windows

Some video driver programs may exhibit conflicts with other programs or device drivers loading in the upper memory area. To troubleshoot this situation, isolate and identify the problem. You can take these steps to identify a video driver conflict and isolate its source:

- Use the F8 step-through bootup procedure to bypass loading the EMM386 file so no drivers will be loaded into the upper memory area.
- If the DOS video driver file is loaded into upper memory (with the DEVICEHIGH or LH command), load them low—remove the HIGH or LH statement from the driver line.
- Start Windows in the Standard mode—enter **WIN/S** at the DOS prompt. Also try starting Windows without using upper memory—type **WIN/D:X**.
- Use a trial-and-error method, *not* loading other device drivers from the CONFIG.SYS and AUTOEXEC.BAT file until you discover the problem. Use the F8 step-through bootup procedure to bypass particular device drivers and TSRs one at a time. (A TSR—**T**erminate and **S**tay **R**esident program—loads and stays in memory until needed while other applications run.) Log your results, and repeat the procedure until you locate the conflicting program.
- Use the latest version of Video For Windows that you have. Many multimedia applications will automatically install a version of the program before it installs the application. If an older version of Video For Windows is installed, a conflict with newer and older files can result.

The QuickTime Video Compression Program

QuickTime is a video-compression program that was first used on Apple computers to compress and play back large video files. Many PC games now use the QuickTime video compression method to store massive amounts of animated graphic files.

The following symptoms indicate a problem with the QuickTime compression program:

- The video samples appear scrambled.
- The colors are reversed.
- Images appear out-of-place or distorted.
- Video colors change at random.

If you have any of these video display problems, check your Windows directory for a file called: QTW.INI. To do this, enter **CD\WINDOWS** at the DOS prompt. Then type **DIR QTW.INI**. If a filename is shown, you can edit it to correct most of the video problems with your game.

The QTW.INI file should contain the following lines to work properly:

```
[VIDEO]
OPTIMIZE=DRIVER (or OPTIMIZE=BMP)
```

If the OPTIMIZE= line is set to anything else, change it to appear as shown above. If it does not exist, create it, save the file, and exit. When you restart Windows, the video images should appear normal.

Part 5

Sound Problems and Solutions

udio for PCs has grown from a practically ignored beep tone to a stereo sound system with recording capabilities. After you experience a game played on a PC with a high-quality sound card, you'll never go back. But getting this level of sound quality on a PC can be tricky. Configuring PC game sound can be complex, and when you alter your sound card configuration, it may cause your PC to lock up.

Knowing how to properly configure and maintain a PC's sound system is crucial. Some game programs alter the sound card's BIOS setup during installation, which may cause audio problems and also disable a CD-ROM drive connected to it. This part will help you troubleshoot and solve common PC game audio problems.

The first section explains how to configure a sound card and explains what some of the parameters are.

Various PC audio systems are described in the second section, and I recommend solutions to common game sound problems. You'll learn how to test a sound card with its hardware-testing software. You'll also see how to set sound mixer levels, log pertinent hardware and software parameters, and check the sound card configuration program.

The third section is for users who have Windows but do not yet have a sound card installed. You'll learn how to play audio

WAV files through your PC speaker with the PC-SPEAKER utility driver, which is available free from online services. Windows events—like Startup and Critical Stop—can be assigned sound effects for fun and games. You'll also learn how to load and configure sound card device drivers properly in the Windows control panel.

Configuring the Sound Card

Loading a game's sound setup information can be a more complicated procedure than most users like to deal with. Game sound setups can range from an automated system that locates the necessary hardware settings to a complex hit-or-miss method.

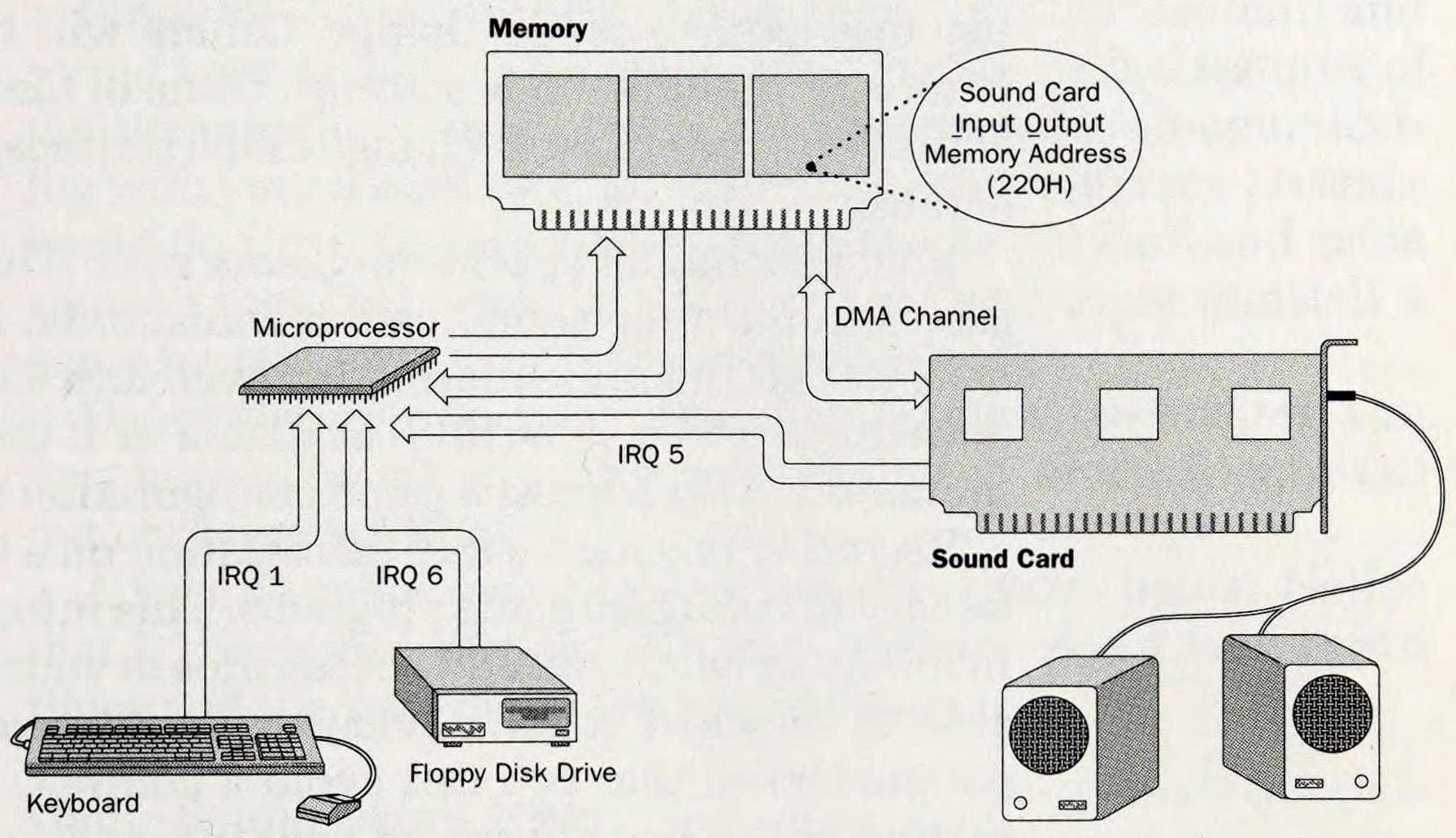
Applications programs and games are programmed to access different types of sound signals from the sound board. Sound types include Voc, Music, and MIDI. You should familiarize yourself with the setup and configuration information found in the sound card manual. Also of prime importance is the sound card program's setup information. You must know *all* of the sound card's hardware setup information in case you have to redo the setup. You'll also need this information to supply to a game's setup program.

The following sections describe the critical sound card hardware setup settings you need to know.

- **Interrupt/IRQ** This selects the hardware "line" that the sound card uses to signal the microprocessor that it needs attention. IRQ stands for **I**nterrupt **Req**uest. IBM AT-compatible PCs have 16 possible IRQ lines. (Not all of them are available for use, though.) All of your hardware devices must have a unique IRQ, and it is critical that you know what IRQ your sound card is set to for proper game setup configuration.
- **DMA Channel** By using a DMA **(D**irect **M**emory **A**ddress) channel, the sound card can speed up data access from computer memory without using the microprocessor. There are eight DMA channels in IBM AT-compatible PCs. Only six of them are available for use by an accessory device. DMA channel 2 is used by the floppy disk drive controller; DMA channel 4 is used by the internal circuitry. Verify which DMA channel your sound card uses for reference.

- **I/O (Base) Address** The I/O (**I**nput/**O**utput), or base, address is the memory area that the sound card will use to communicate with DOS and other programs. The sound card SET command line in the AUTOEXEC.BAT file assigns the I/O memory area. Hardware switches, jumpers, or a utility program will also determine the I/O address used by the sound card. When I/O data transfers are necessary, microprocessor intervention is required (unlike DMA channel access). See the following illustration:

By signaling the microprocessor with IRQ line 5, the sound card can transfer data directly to and from memory without further interrupting the processor from its other duties.



- **Accessory Settings** Check the settings for a game port (joystick or MIDI device) and CD-ROM drive IRQ and I/O address settings (if installed).

Advanced Sound Card Settings

Some high-end sound cards have multiple mode configurations. If you own one, it is crucial that you read its manual thoroughly. You may be required to change the operating mode of the sound card *before you start a game*. And you'll have to log each game's sound card mode requirements in more detail. A high-end sound card manual will explain the various modes it operates in and what commands you can type at the DOS prompt to change modes.

A high-end sound card will generally include the following modes:

- **FM Mode**. For FM (**F**requency **M**odulation) music emulation.
- **MT-32 Mode**. This is compatible with the Roland MT-32 mode.
- **General MIDI Mode**. This is the MPU-401 compatible mode.

Follow the sound card instructions exactly when changing modes. Some of them want you to exit from Windows first before making a mode change. Others will have simple commands to alter the mode settings. Some of them require starting a utility program first to change mode settings. Read the manual carefully.

If you encounter special problems with Windows and certain games, contact the sound card manufacturer. Most of them will have troubleshooting information available. Check if they have a bulletin board service (BBS) available or if they can fax you information. Also request a game configuration chart, if available.

Record your sound setup information on a log sheet so it will be easy to configure game programs. This information will come in handy in when you add accessories to your PC. You'll also be able to check if other devices are set to your sound card's parameters so that you can avoid a conflict. See the reference section of this book to record your information on a sound card log sheet.

To ensure that your PC is setting up your "sound environment," enter **SET** at the DOS prompt. You will see one or more lines appear displaying all of the "environments" that your system is now set to recognize, including your sound card.

These are typical Sound Blaster SET lines:

```
SET BLASTER=A220 I5 D1 T2
SET SOUND=C:\SBPRO .
```

These lines should be listed in the AUTOEXEC.BAT file. The SET BLASTER line displays the information that is found on the setup utility screen: The base address is A220, the **I**nterrupt (or IRQ) number is 5 (indicated by I5), the **D**MA channel is 1 (D1), and the **T**ype is a Sound Blaster Pro (T2).

The SET SOUND line informs MS-DOS and other applications where the sound card device driver and utility files are located on the hard disk.

Your hardware setup information (and SET environment information) doesn't change. But the sound card *type* that a game uses to identify and work with your particular sound card does. Even though your sound card is probably Sound Blaster-compatible, many programs will not produce all of the sound types unless another sound card type is chosen in the game setup program during installation.

Since the Sound Blaster type is not an official standard and sound card makers don't want to be limited to the features of their competitors, some games may have trouble communicating with your sound card hardware and device drivers. I recommend that you create a log sheet of your sound card and game sound types that work properly in case you must reinstall a game (or talk with a technical support person).

Depending on how you set your game sound parameters, you may not hear some sounds, while others may intermittently cut out or change volume.

A sample game sound settings chart is shown below. Notice that it displays a single game with various sound card board types and the recommended sound setup.

Game Sound Setup Menu

```
Language = English
Music Device = Sound Blaster
Sound FX Device = Sound Blaster
Use Joystick = No
Redefine Keys
Quit Install
```

Music Device/Sound FX Device

These two menu items select the sound card for each of the two types of sound output. An example of the menu is shown here.

```
Music Device
No Music
PC Speaker
Ad-Lib
Sound Blaster
Roland MT-32/LAPC-1
Roland Sound Canvas
```

Advanced Game Sound Setting

Sound Card	Adlib	SB	Pro I	Pro II
Sound Galaxy	*	*		
BX-II (PC Audio)	*	*		
PC Audio II	*	*	*	*
Sound Galaxy NX Pro	*	*	*	
Sound Blaster Pro	*	*	*	
Sound Blaster Pro II	*	*	*	*
Sound Galaxy Pro 16 (Mozart)	*	*	*	*
Forte-16	*	*		

Solutions to PC Game Sound Problems

Armed with your sound card manual and setup information, you're ready to tackle the peskiest audio-related problems that occur after a game installation.

- **After installation, some or no sounds work in a game application.** First, test the sound card from its testing program utility—found in the sound card's subdirectory. Ensure that the IRQ, base address, and DMA channels are set properly. After saving the settings, turn off the PC and wait at least 5 minutes before rebooting. The sound card should be operating properly. If Windows is installed, test for sound in the sound application of the control panel. If you don't hear any sounds or they do not sound right, reinstall the sound card utility software.
- **You don't hear any sounds in Windows.** Assuming sounds work properly in DOS (do a test in the sound card's test program), go to the Windows Main group and choose Control Panel. From there, click on Sound. The dialog box that appears will have an Enable System Sounds checkbox at the bottom. Make sure there is a checkmark in the box. To test for sounds, click on a Windows event (like Windows Start) and click on a sound file (like DING.WAV), and then click on the Test button. You should here a sound coming from your speakers. If not, check your sound card's Mixer Control program in Windows from the sound card's Window group (or icon). Make sure all of the sound levels are up and that the audio output is activated. See your sound card manual for details about your particular program. If you still do not get any sound in Windows, reinstall the sound card drivers with the installation diskettes.

- **After installing or playing a game, Windows makes a repeated sound.** This happens when a game alters the sound card settings in the BIOS ROM chips on the sound card or in the sound card's environment string. Sometimes the problem will disappear if you exit Windows and turn off the PC for at least 5 minutes. If it does, identify which game caused the problem and try a different configuration for sound or contact their tech support department. If rebooting did not correct the problem, you'll have to check the sound card's drivers for Windows in the control panel's Drivers program. Highlight your driver from the installed list and click on the Setup button. Check all of the standard settings—IRQ, base address, and DMA channel. If a setting has changed (good thing you have the settings written down, isn't it?), input the proper information.

- **Sounds are too loud or soft and volume control on the speaker doesn't work.** Most sound cards include a DOS and Windows mixer control utility program that allows you to set sound levels. Check your manual for details on starting these programs, and familiarize yourself with their functions.

- **Audio CD doesn't play, and you can't choose CD audio from the Windows Media Player.** You may not have the Audio CD driver loaded for Windows. Go to the Drivers application in the Windows control panel and check the installed drivers list for [MCI] CD Audio file. If it isn't there, click on the Add button and choose it from the list. Have your Windows diskettes ready, because you'll be prompted to insert a Windows diskette in drive A. After you load from your disk (usually found on Windows disk number 4), you'll have to restart Windows for the changes to take effect. Restart Windows and click on the Media Player icon in the Accessories group. Then click on the Device menu and choose CD Audio.

- **Sounds will not play. You get no sound environment line after typing SET at the DOS prompt.** Locate a previous version of your AUTOEXEC.BAT file and save it to the root directory of your hard drive. See the "Storage Issues" section of this book for more information. You can also reinstall the sound card using the installation disks to restore the AUTOEXEC.BAT file parameters.

- **You cannot locate the sound card drivers and test utility files on the hard disk.** Check the sound card manual for the directory name. If you still can't find the sound card driver directory, reinstall the sound card using the installation disks.
- **You don't have a manual and do not know how to test the sound card.** Check the reference section of this book for the name and phone number of your computer manufacturer or the sound card maker.
- **You don't know what the old CONFIG.SYS and AUTOEXEC.BAT file settings were.** Locate another copy of the system files on the hard disk; see the "Storage Issues" section for information. Reinstalling the sound card disks will create new system files with the proper parameters automatically set.
- **The game doesn't recognize your particular sound board. Sounds won't play properly.** The game may be programmed to recognize only early Sound Blaster type numbers. Try changing the SET BLASTER type number (e.g., try entering **T1** or **T2**). Experiment with different DMA channels and IRQ numbers with the game's setup utility. If you have a 16-bit sound card, try using the higher DMA channels—4 through 7—for one game and record your results. You can change the DMA and IRQ settings of your sound card in its setup utility program. For Windows games, try altering the sound card driver settings in the Drivers option of the control panel. Click on the sound card driver on the list of installed drivers and then click on the Setup button. Write down the original settings before making any changes.
- **After using Windows, your DOS game has incorrect sounds.** Windows can sometimes leave a sound card in an unstable state. To eliminate the possibility of sound problems in a DOS game after using Windows, first exit Windows and reboot the PC. You should turn the PC off for at least 15 seconds and then turn it back on. If the PC is configured to start Windows automatically, use the F8 selective bootup routine to bypass processing the WIN command in the AUTOEXEC.BAT file.

- **Game locks up when using the QEMM memory manager software utility.** The QEMM Stealth mode option can cause problems with DMA access, resulting in system lockup. To test this, bypass the QEMM device driver lines in the CONFIG.SYS file and try the game. The Stealth mode line will appear similar to the one below:

```
DEVICE=C:\QEMM\QEMM386.SYS  ST:M
```

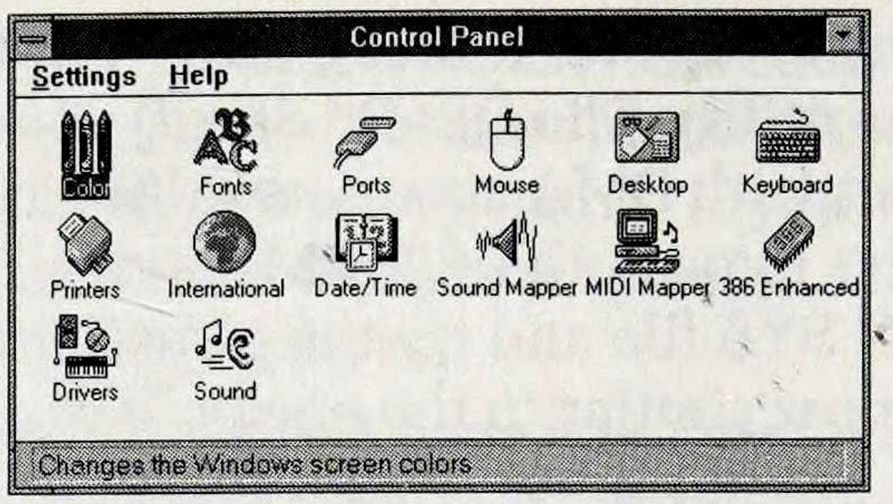
  The *ST* at the end of the line stands for Stealth. Another way to test this type of problem with QEMM running is to first back up the CONFIG.SYS file and then edit it to remove the ST:M (or ST:F) option from the line. Save the file, reboot the computer, and test the game.

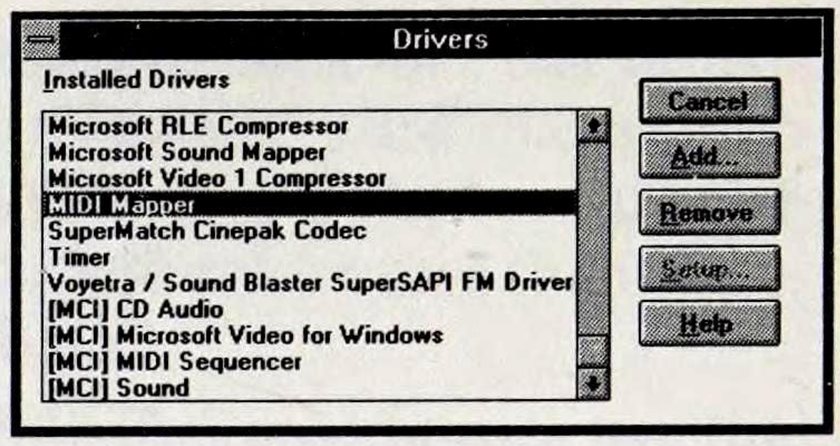
Using the PC-SPEAKER Driver for Windows Sound

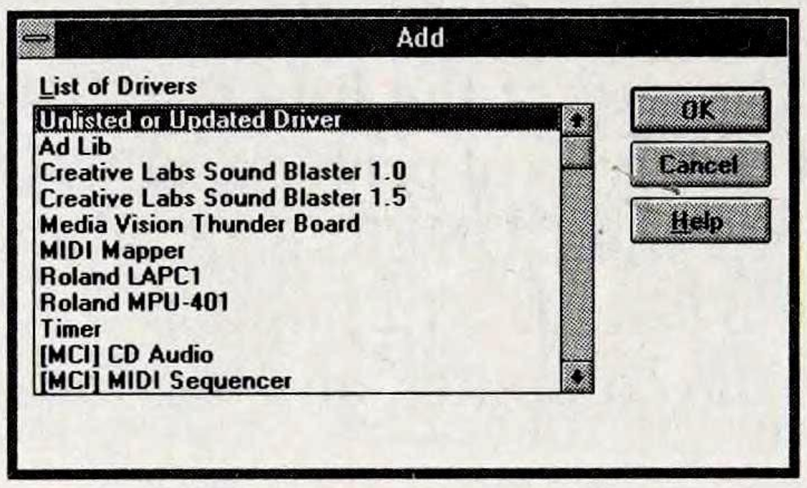
If you do not have a sound card in your computer and you use Windows, a free device driver program is available so your internal speaker can play sound files. With this driver loaded in Windows, you'll be able to play back WAV files from the Sound program in the control panel and in the Sound Recorder application in the Accessories group. You won't be able to record sounds or play back MIDI files, but you can assign sounds to Windows events like Windows Start and Critical Stop. You can also obtain (free from most BBSs), install and play back more WAV files from your Windows directory.

The program file, called SPEAK.EXE, is a compressed file that includes the following files: SPEAKER.DRV, SPEAKER.TXT, and SPEAKER.INF. The SPEAK.EXE program is available from Microsoft through the Microsoft Download Service. See Part 8 for information on retrieving files online from Microsoft. The file is also available from CompuServe: Type **GO CIS:MSL** to go to the Microsoft Download Library.

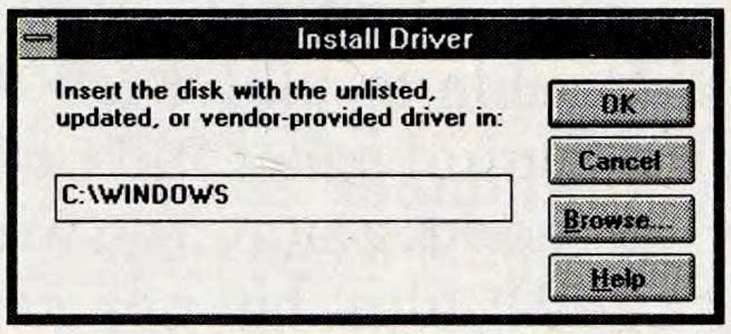
Once you have the file on a disk (or loaded on your hard drive), you can easily install it into your Windows control panel program Here's how: From the Windows Main group, double-click on Control Panel. Then double-click on the Drivers icon. Next, click on the Drivers icon. Choose the first item on the list, Unlisted or Updated Drivers.



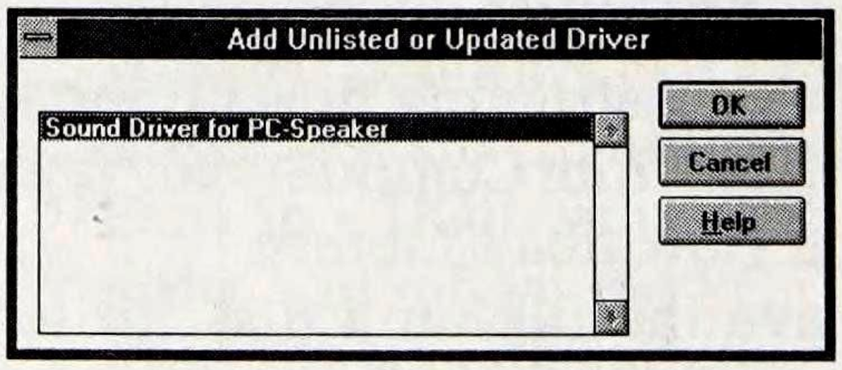




If your files are on a diskette, type in the appropriate drive letter and click on the OK button. If they are installed on your hard drive, type in the drive letter and directory name and then press OK.

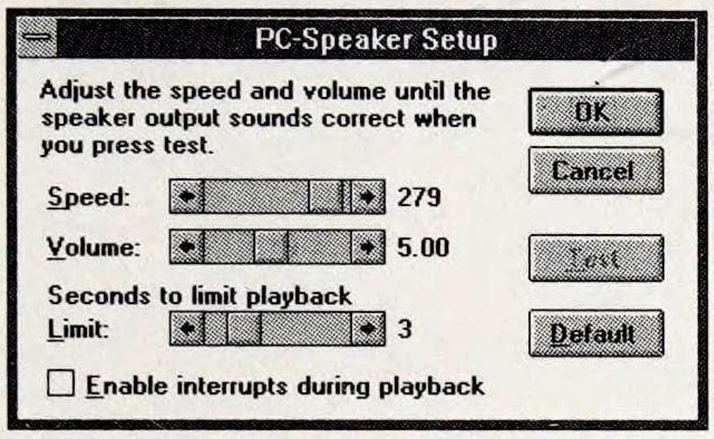


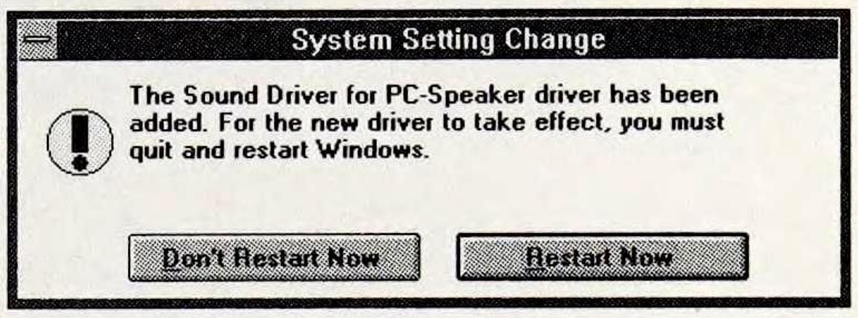
A Sound Driver For PC-Speaker window should appear. Click on the OK button to complete the installation. If the window does not display, check to see that you entered the right directory name and make sure that the file SPEAKER.DRV is not corrupted.



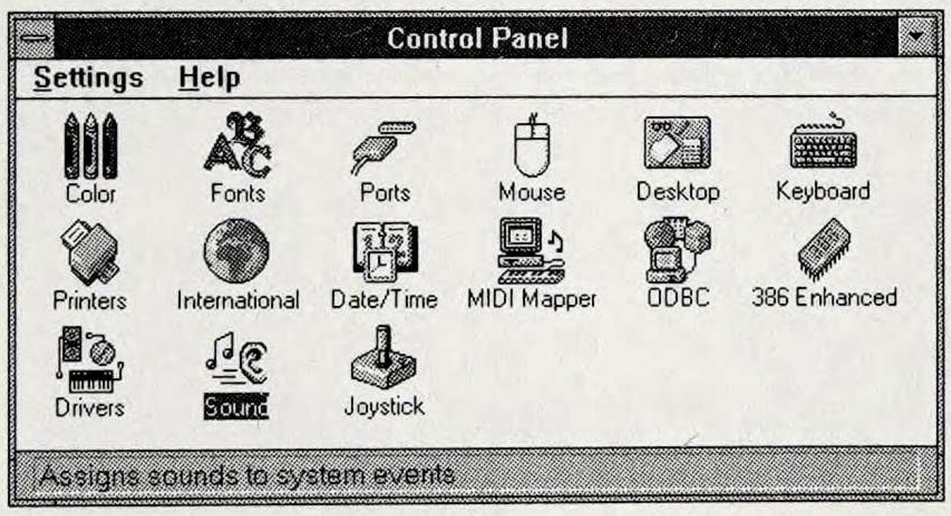
When the installation is complete, you'll see a PC-SPEAKER window appear that will allow adjustment of the playback speed, volume level, and playback time length. You can also enable hardware interrupts (IRQs) during playback. This will allow your

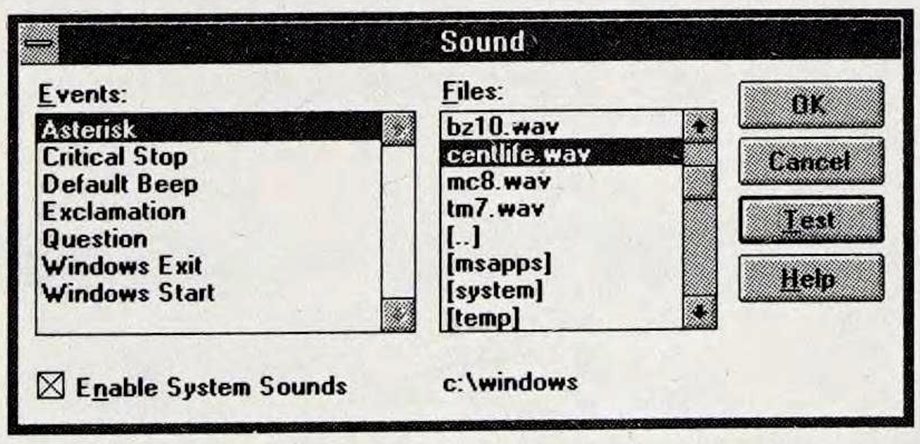
mouse, keyboard, and other devices to continue to function while sounds are being played (but the sound quality may suffer). When you have selected the choices you prefer, you can click on the Test button. The Windows DING.WAV file will play, so you can hear the way your parameters affected sound playback. When you are satisfied with your choices, click on the OK button.





Now you can close the Drivers window and click on the Sound icon in the Control Panel group. From there you can test the WAV files included with Windows and assign them to Windows events.





Some audio files may sound distorted on playback. If so, you can return to the Drivers icon in the Control Panel group, click on the PC-Speaker driver on the Installed Drivers list, and then click on the Setup button. From there you can make adjustments. Click on OK to save the changes and exit.

Part 6

Storage Issues

Most modern games have to be initially installed from a diskette or CD-ROM (or downloaded from a modem) and then stored on your hard disk. This section covers the fundamentals of installation and storage of games on your hard disk drive. The basics of file compression, disk optimization, virus checking, file recovery, and backup issues will also be described. All of the utilities needed to perform these tasks are included with DOS 6.2. Commercial utility programs can also be used to perform the same functions if you prefer.

Disk Drive Operation and Optimization

I highly recommend that you read a comprehensive reference book on MS-DOS and hard disk management for a complete understanding of program file storage issues. The following information is not meant to be comprehensive, just a quick review of the basics.

How to Store Files and Programs on Disk

Some users copy files from the A drive (or the B or D drive, for CD-ROMs) to the C drive directly and wonder why they receive "Hard disk is full" messages, knowing that they have many

megabytes of hard drive space free. When installing a game, always refer to the included instructions for loading information. Most games will create a new directory on the hard disk. But if you use games from shareware disks, copies you get from friends, or programs you download from a modem, installation errors can occur that will reduce performance.

When all of the game files are located in a single directory, it is easy to locate the directory, delete the files, and restore the program. If a game is copied to another existing directory, it is virtually impossible for a user to know which files belong to which program. Users who want to erase unneeded files from their hard drive are confused about which files to delete or reinstall. They may delete files that belong to another program. Plus, some game programs create temporary files while running and those files can become unidentifiable too.

The following figure illustrates a typical, *clean* hard disk directory tree. Notice that the root directory (C:\) contains very few files. You should keep it that way. In fact, if the root directory contains more than 512 files, you cannot create a directory on your hard drive! Some users have unknowingly copied programs from a floppy drive to their drive C, filling up their root directory with program files.

A clean directory tree

```
DIRECTORY OF C:\

IO          SYS
MSDOS       SYS
COMMAND     COM
386SPART    PAR
AUTOEXEC    BAT
CONFIG      SYS

DOS         <DIR>
WINDOWS     <DIR>
GAMES       <DIR>
TEMP        <DIR>
```

You can use the DIR and TREE commands to see a directory structure of your hard disk: Type **DIR/P** or **TREE | MORE** at the DOS prompt to see a subdirectory listing or a tree branch-style visual display. (The | is called a pipe symbol; it is on the backslash key.) All of your major programs should be located in their own directories. You should also have a directory to store

temporary files. If you don't, create a directory with a name like C:\TEMP. To do this, change to the root directory (type **CD** and press Enter) and create the directory by typing **MD TEMP**. Then add this line to your CONFIG.SYS file:

```
SET TEMP=C:\TEMP
```

It is important to store temporary files created by games and other programs in a single directory. This way, if a program locks up and doesn't delete the temporary files, you can do it yourself to clear hard disk space.

If the game doesn't have obvious installation instructions or a SETUP.EXE or INSTALL.EXE file on the diskette, create a separate directory for it and copy the files there. First, move to the root of the hard drive—type **CD** and press Enter. Then create a game directory by typing **MD GAME1**. Next, copy the files from the A drive to the game directory—enter **COPY A:*.* C:\GAME1**. To access the game from the hard drive, you must first change to the game directory—type **CD\GAME1** and press Enter. Then you have to type in the name of the file that loads or installs the game.

Finding Lost Files

The files that most often get lost on PCs are the system files (CONFIG.SYS and AUTOEXEC.BAT). Yet there are probably more copies of these files on a typical computer than there are of any other! The reason is that virtually all programs and utility software that modify these files will rename the original versions. The trick is locating the files and placing them back into the root directory with their original names.

When you have lost or inadvertently rewritten your system files, you can use the DIR and REN commands to find usable older versions to recover from an error. The directory command is most widely used to view the contents of a directory. But it can be put to use as a file locator if you add the /S parameter.

As an example, to locate all of the CONFIG files (not just CONFIG.SYS files, because the extension will most likely have been changed) on the entire hard disk, type **CD** and press Enter. Then, at the DOS prompt, type: **DIR CONFIG.* /S**. The /S parameter specifies to search every subdirectory, and the asterisk (*) is a wildcard character. Thus, when you use this command, DOS will search every subdirectory for any CONFIG file on the hard disk.

You'll probably see a listing of many CONFIG files in various directories. You can change to a particular directory and view the file by entering **TYPE CONFIG.*extension***. If the file is a copy of the original CONFIG.SYS file, you can copy it to the root directory and use it. If the file appears to be a copy of the CONFIG.SYS file but has a different name (such as CONFIG.OLD), you must rename it. Programs and utilities that keep a copy of your original system files must rename them, because directories cannot contain files with duplicate names.

The DOS command REN allows you to rename files easily. Simply type **REN**, the present filename, a space, and then the new filename. For instance, to rename CONFIG.OLD to CONFIG.SYS, change to the directory that the file is in and type **REN CONFIG.OLD CONFIG.SYS**. Then copy the file to the directory where you need it. For instance, to copy the CONFIG.SYS file to the root directory, type **COPY CONFIG.SYS C:**.

You can perform the same file searching and renaming procedure on AUTOEXEC.BAT and other important files, including the Windows SYSTEM.INI and WIN.INI files.

If you've *really* lost important files, you can sometimes recover them with the Undelete program, included with DOS 6 and above. See the next section for information on recovering deleted files.

Recovering Deleted Files

DOS 6.2 includes an Undelete utility program with three levels of file recovery methods. The standard Undelete program can recover files that were *recently* deleted from a disk—time is crucial when trying to recover deleted files.

Many deleted files can be recovered, because DOS doesn't really delete or shred the contents of a file when you use a delete command. DOS keeps track of file information with a master file called the File Allocation Table (FAT). This file contains information about all of the data stored on the disk. When a delete command is processed, the File Allocation Table changes the first character in the filename to signal DOS that the file has been deleted and that its disk space is available for new files to use. The original version of the deleted file is still intact at this point.

If the UNDELETE command is used soon after a file delete command was processed, the file can very likely be recovered.

After starting Undelete, the program will identify files that can be recovered and ask you for the first letter of the filename to rename it. But if other files were copied to the disk *after* the file was deleted, some of them may use the disk location that the old file used. In that case, the older file is unrecoverable.

Undelete cannot restore a removed directory, nor can it retrieve a file if you have removed the directory that contained it.

DOS 6.2 includes the standard Undelete program, a Tracker program, and a Sentry program. The basic Undelete program works from DOS or Windows. The Tracker and Sentry Undelete options can be set from the program's menu selection.

To undelete a file with the standard Undelete program, at the DOS prompt type **UNDELETE C:*directory path**filename.extension***. If you don't know the filename, or if you want to recover a large group of files from a directory, just use *.* as the filename. The *.* is a wildcard that tells DOS to use all files with any three-letter extension.

You can use GAME.* to find every file that begins with GAME, regardless of the extension. Or you can use *.BMP to request every file that ends with the extension BMP, regardless of the filename.

Undelete Tracker is a memory-resident program that keeps track of file information and its location throughout the disk (a file may be fragmented and located in various sectors on a disk). This tracking system keeps track of the File Allocation Table information so that if the file is deleted, all of the filename and location information is already available.

The Undelete Sentry program is also memory-resident. It creates another copy of your deleted file in a reserved hard disk location, from which the file can be recovered fully intact. If hard disk space becomes low, the reserved hard drive area will give up its *oldest* file space for use. So, even if you have Sentry activated, it is best to try to undelete a file as soon as possible.

To start the DOS Undelete program, just type **UNDELETE** at the DOS prompt. To start it in Windows, you can click on the UNDELETE icon in the Microsoft Tools Windows group. Or, from the File Manager, click on the Tools menu and choose Undelete.

DOS 6.2 creates a Microsoft Tools group window during the upgrade process. If Windows is later reinstalled, you won't see the group. To recreate it (without installing DOS 6.2 again), use the **SETUP** command at the DOS prompt.

For more information about the DOS 6.2 Undelete program, enter **HELP UNDELETE** at the DOS prompt.

Virus Checking with the DOS VSAV Utility

It is important to periodically check your hard disk and program diskettes for viruses. A *computer virus* is a small program that can attach itself to your computer's hard disk files from a floppy disk used to install a program or from files downloaded in your PC with a modem. A virus can corrupt your data and hard disk system files slowly and in unusual ways.

These are some common virus symptoms:

- Your PC restarts itself at unusual times, without user input.
- File sizes and last-saved times and dates change mysteriously.
- Files or directories disappear or the amount of available disk space changes for no reason.
- The PC slows down although you have not loaded any programs and you are using Turbo mode.
- You get unusual screen displays or messages.

The DOS 6.2 Microsoft Anti-Virus program can check for over 1,000 known viruses either manually or automatically. The MSAV program is available from DOS or Windows.

You can run the Microsoft Anti-Virus program manually or have it constantly check for viruses with the included VSAFE program. VSAFE continuously monitors your computer for viruses and displays a warning when it finds one. VSAFE is a memory-resident program that uses 22K of memory.

Do not use the VSAFE command when you are running Windows.

To start the DOS MSAV program, just type **MSAV** at the DOS prompt. To start it in Windows, you can click on the Anti-Virus icon in the Microsoft Tools Window group. Or, from the File Manager, click on the Tools menu and choose **Anti-Virus**.

For more information about the DOS 6.2 Undelete program, type **HELP MSAV** at the DOS prompt.

Virus-scanning software needs *constant* updating. Check BBSs for information on newer virus types and their symptoms. Download new virus-detecting program utilities—from reputable bulletin board services only! Also check for commercial virus-scanning software in retail stores and check magazine articles for review information.

To prevent viruses from appearing on your system, you should take the following precautions:

- Be wary of loading non-commercial software diskettes on your hard disk.
- Do a virus check on diskettes and CDs *before* you install them.
- Use BBSs on which the system operator scans regularly for viruses.
- Write-protect your program diskettes so they will not be infected during a reinstallation.

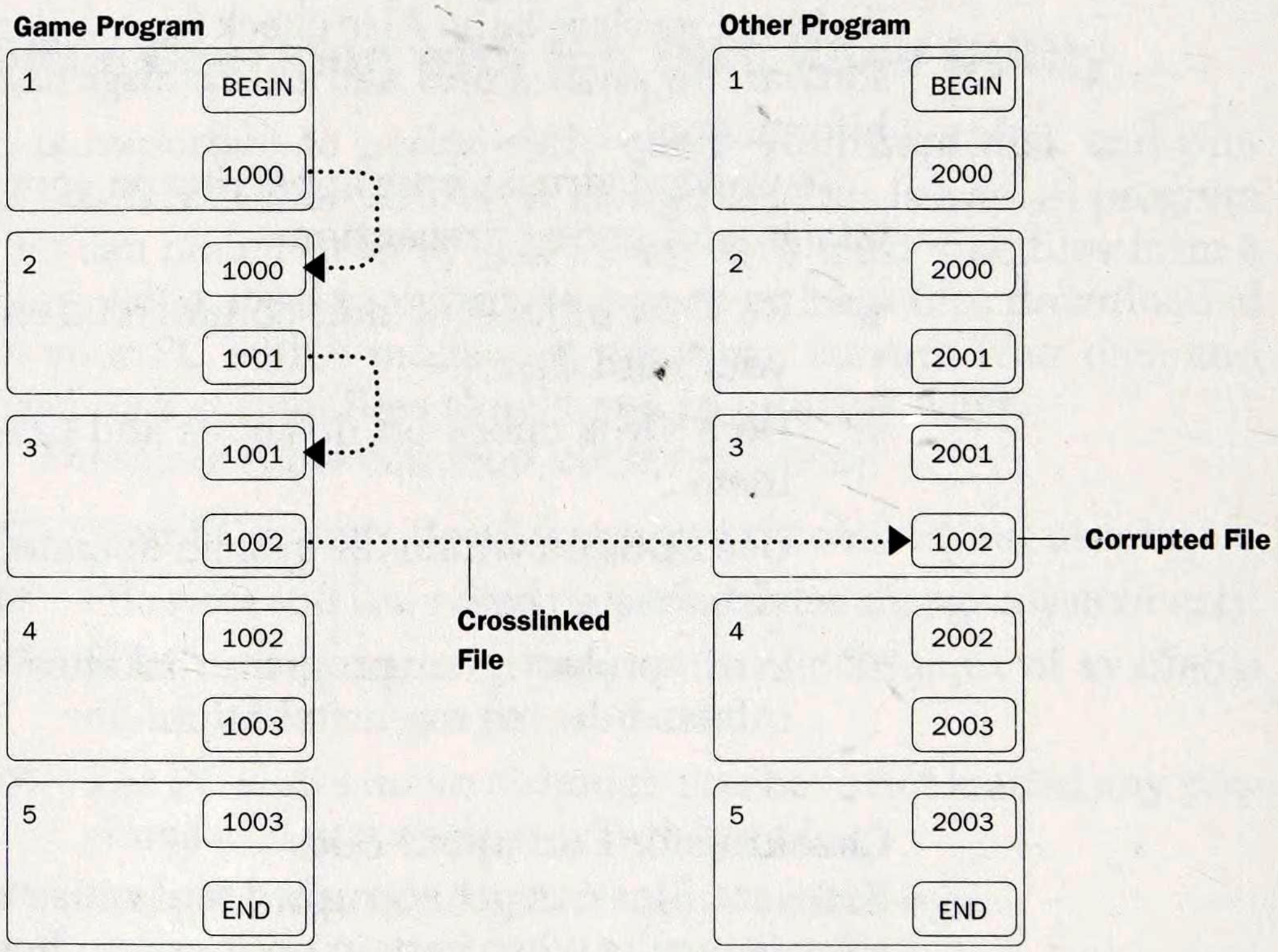
Checking for Corrupted Files

Software files can get corrupted and cause system lockups and strange results when certain options are chosen. Your game program may still run, but some of the files within it are incomplete and unusable. If you reinstall the program, the problem may still not be corrected entirely unless the corrupted file *remnants* are removed.

A corrupt file may not have the correct "next allocation unit address" number, which is its location relative to its sister files in the program. In this case, it is called a lost cluster or a *lost allocation unit*. If a cluster loses its connecting address numbers, it becomes lost from the rest of the file chain. The file is incomplete and will not function properly. The hard disk will not allow the cluster bytes to be used for other programs that need it, and it simply wastes file space.

In other cases, a file's connecting numbers get altered so that they match the numbers belonging to another file. When that happens, the two files, and the other files in the group, become a cross-linked chain (see the following illustration). The DOS Checkdisk and Scandisk programs can find lost allocation units and cross-linked chains and correct many problems with them. Or they can restore the bytes back for use by other files on the hard disk in the future.

Files become cross-linked when a corrupt file takes on the "next file location number" of another file.



The Checkdisk command can check a disk and display a file usage and memory usage status report. Its main use is to detect errors on the disk or in its file allocation table. To perform a Checkdisk on your hard drive, type **CHKDSK** at the DOS prompt.

Using CHKDSK /F will fix errors on the disk. Typing **CHKDSK/V** displays the full path and filename of every file on the disk. CHKDSK does checks on the memory in the PC and on the directories in the specified (or default) drive. Any filenames specified are checked for non-contiguous sectors.

To avoid problems caused by open files, avoid using CHKDSK from another program (like the DOSSHELL or another menu program) or from within Windows. Also, the CHKDSK command does not work on drives formed by the SUBST, JOIN, or ASSIGN commands.

For more information about Checkdisk, type **HELP CHKDSK** at the DOS prompt.

The DOS 6.2 Scandisk program goes a step beyond Checkdisk. It not only checks your files for errors, but it also checks the physical attributes of the hard drive surface. Scandisk is a disk analysis and repair utility. It checks for errors and corrects any problems it finds. It is designed to work on both regular drives and Doublespace compressed drives.

Scandisk can be started at the DOS prompt by typing **SCANDISK**. For more details on Scandisk, type **HELP SCANDISK** at the DOS prompt.

Backing Up Your Hard Disk

Making backup copies of system files and game files is crucial to ensure that you can restore your system after a system crash. DOS 6.2 comes with a free utility program—two actually, one for DOS and one for Windows—called Microsoft Backup (and Microsoft Backup for Windows). These utilities are menu-driven and allow you to back up files in user-defined ways. You can save the specified backup configuration as a file and choose it again from a menu or from the DOS prompt.

For instance, you can decide to back up files from certain disk drives or after certain dates, or you can specify all of the files you desire for a full backup. Later, you can perform an incremental backup to copy only newer files (the ones that weren't copied from the previous session).

The DOS 6.2 Backup program will also compress the files on the diskettes to save time and reduce the number of diskettes needed for backing up files. Error-correcting routines are built into the program to prevent lost data.

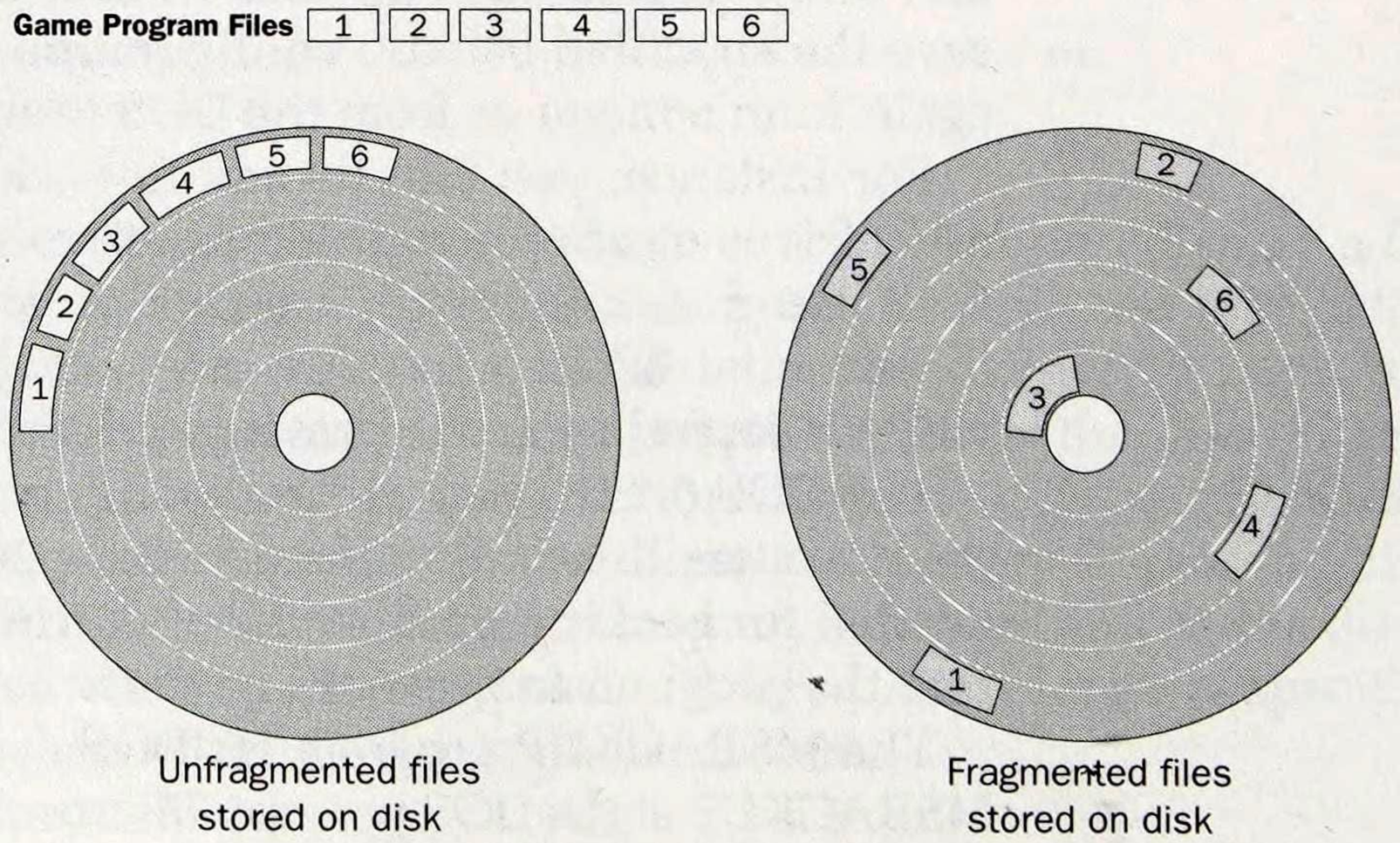
The MSBACKUP program for DOS can be started by typing: **MSBACKUP** at the DOS prompt. Microsoft Backup for Windows can be launched from Windows in two ways: You can click on

the Microsoft Backup icon in the Microsoft Tools Windows group. Or, from the File Manager, click on the Tools menu and chose Backup.

The Microsoft Backup program for DOS 6.2 is different from the Backup program included with DOS 5. Any files that were copied and saved to disk with the DOS 5 Backup program cannot be restored using the restore option in the DOS 6.2 Microsoft Backup program (neither the DOS nor the Windows version). But DOS 6.2 includes the DOS file RESTORE.EXE for restoring files made with the DOS 5 backup program. Simply type in the restore command at the DOS prompt to restore those files. Type **HELP RESTORE** Enter for more information about using the restore command. Or see the MS-DOS manual for details on the restore command syntax. Both DOS 5 and DOS 6.2 manuals cover using the restore command for DOS 5's backup program.

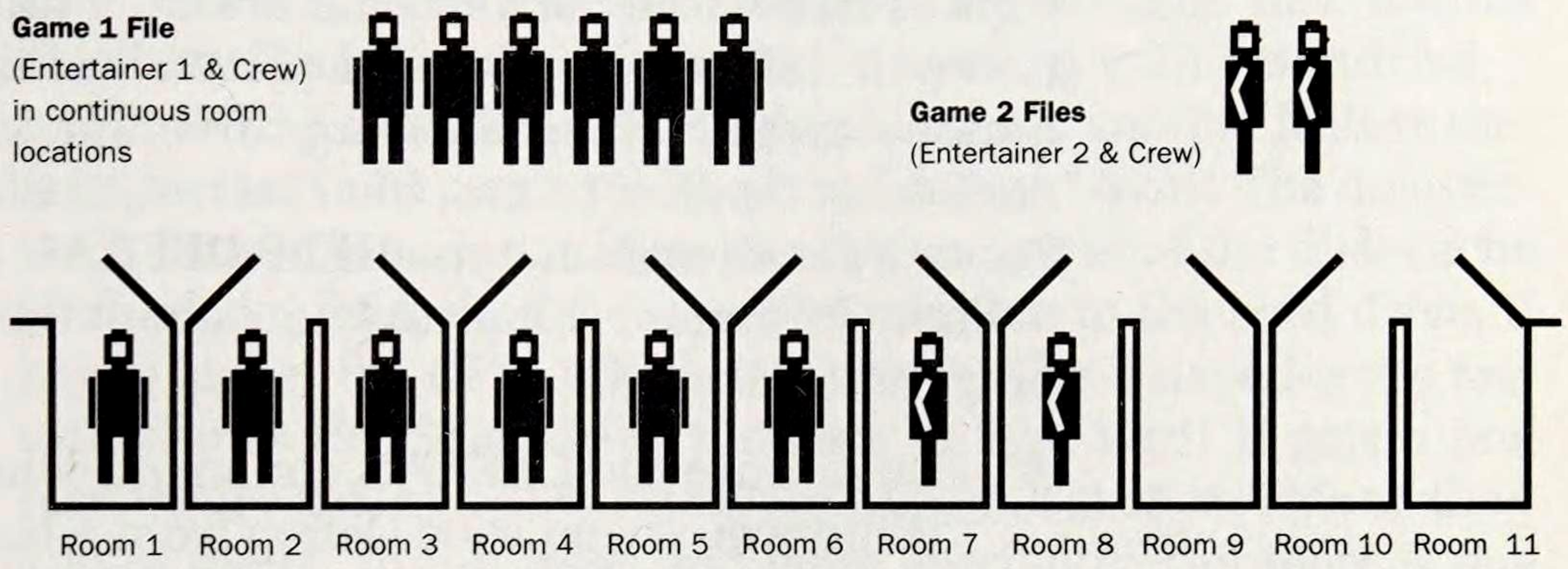
Optimizing Your Hard Disk (Defrag)

Every time you save a file to your hard drive, its organized structure suffers. Eventually, the hard disk drive takes a long time to locate and reassemble files and program segments. This happens because of the hard drive's file-saving design.



To explain how this happens, we'll use the PC-as-house analogy to see how files get fragmented into non-contiguous (separate, non-adjacent) sections. The following figure shows the PC house and guest rooms. Imagine that Entertainer 1 and her staff and crew are located in rooms 1 to 6. Entertainer 2 and his crew are placed in rooms 7 and 8. When group 1 needs to assemble to play in the living room area, the house manager only needs to go to adjacent rooms 1 to 6 to notify the band members.

Fragmented files are like band members that must be located and reassembled when they are needed.



If Entertainer 1 adds more members to the band, they must be housed in a room, too. But the next rooms available are 9, 10, and 11. Now the house manager has to go to rooms 1 to 6 and then over to rooms 9, 10, and 11 to assemble the entire band.

A defragmentation program can reassemble the fragment sections of your files and place them contiguously (next to each other) for faster access. On a heavily fragmented hard drive, running a defragmentation program can cut the file access time in half!

Since a defragmentation routine must copy and delete files, there is a possibility of data loss or file corruption taking place (it's a small chance, but worth preparing for). Before optimizing the hard disk, first back up all of your files and check their validity. See the

"Backing up Your Hard Disk" section in this chapter for more details on backing up files for safekeeping.

MS-DOS 6.2 includes a utility program called Defrag that can perform file placement optimization. For more information about its features and operating instructions, see your MS-DOS manual.

The Defrag program can perform two types of disk optimization routines. It can perform a file defragmentation, which rearranges the hard drive file fragments, putting file segments back together. This takes the least amount of time, but it leaves many gaps of free space between file areas. A full optimization routine will defragment files and place all of the files in one contiguous area, leaving one large free space area. The second method is the best to use, but it takes substantially more time. For more information, type **HELP DEFRAG** at the DOS prompt.

Some important things to know about the DOS Defrag utility program:

- Do not use the DEFRAG command when you are running Windows. If you start Defrag from a batch file, menu utility, or shell program such as DOSSHELL or Microsoft Windows, you may lose data.
- Defrag cannot be used to defragment files on network drives or drives created with the DOS Interlake program utility.

Disk Cache Utility Programs

Disk cache programs were developed to prevent computers from searching for repetitive data unnecessarily. A computer memory search for data is at least ten times faster than a disk-based search for the same information. A disk cache program will read information that is fetched by a disk into a reserved memory area. When the computer requests data from the disk again, the disk cache program will intercept the request and check the cached memory area for the data. If it is there, the data will be processed from cache memory. If the data needed is not there, the hard drive will process the request normally.

DOS 6.2 comes with a disk cache program called Smartdrive. It is loadable at the DOS prompt or from the AUTOEXEC.BAT file. A typical Smartdrive line looks like this:

```
C:\DOS\SMARTDRV.EXE 1024 256
```

This line loads the SMARTDRV.EXE Smartdrive program file from the DOS directory. The 1024 designation makes Smartdrive reserve 1024K (1 megabyte) of system memory for the Smartdrive cache program. The 256 designation allows Windows to reduce the memory cache size to 256K if memory resources become depleted.

It's important to keep in mind that when Smartdrive is loaded, it reserves its memory from all other programs. If a game needs more RAM (either expanded memory or extended memory) than is available, you may have to reduce the Smartdrive cache size. See the "Memory Issues" section for more on working with Smartdrive.

The DOS 6.2 version of Smartdrive also has another feature that is important to be aware of; it's called *delayed write*. The delayed-write feature is an innovation that is the reverse of the disk-cache fetch mode. Each time data needs to written to the hard drive, it has to signal the CPU, which takes time. The delayed-write feature allows the Smartdrive program to wait until it gets a few requests for data and then writes them back all at once. This method allows the PC to run faster and more efficiently. But there is one drawback to this feature.

If the computer is turned off or if it locks up before Smartdrive can write data back to the disk, the data might get lost. To ensure that no data gets lost when the Smartdrive write-back feature is enabled, wait at least five seconds at the DOS prompt before shutting off the computer. This will give the disk cache enough time to "flush" its data.

To check the status of Smartdrive (which drives it is caching, the amount of memory reserved, and its delayed-write status), at the DOS prompt, type **SMARTDRV**.

You'll receive a screen display that looks something like this:

```
Microsoft SMARTDrive Disk Cache version 5.0
Copyright 1991,1993 Microsoft Corp.
Cache size:   1,048,576 bytes
Cache size while running Windows: 131,072 bytes
Disk Caching Status
drive   read cache   write cache   buffering
---------------------------------------------
A:          yes           no           no
B:          yes           no           no
C:          yes           yes          no
Write behind data will be committed before command
prompt returns.
For help, type "SMARTDRV /?".
```

There is an undocumented Windows program utility that allows you to view the status of the Smartdrive program and alter its settings. The program is called SmartMon (**Smart**drive **Mon**itor). DOS includes a file called SMARTMON.EXE that Windows can run. To start the SmartMon program in Windows, in the Program Manager, click on the File menu and choose Run. On the command line, type **SMARTMON** and click on OK. The Smartdrive Monitor utility will appear in a window, which you can use to view and alter its settings. For more information about the Smartdrive disk cache, see your MS-DOS manual or at the DOS prompt, type **HELP SMARTDRV** or **SMARTDRV /?**.

Configuring Smartdrive Settings

To check the proper size and operation of Smartdrive, type **SMARTDRV /S** at the DOS prompt. The screen display will show the cache hit-and-miss rate, the present size of the Smartdrive cache, and a list of each drive, showing which ones are being cached. The statistics displaying the hit-and-miss ratio are important to configuring your Smartdrive settings. This is a typical Smartdrive display:

```
C:\WINDOWS>smartdrv/s
Microsoft SMARTDrive Disk Cache version 5.0
Copyright 1991,1993 Microsoft Corp.
Room for    2 elements of   8,192 bytes each
There have been 392 cache hits and 925 cache misses
Cache size:   16,384 bytes
Cache size while running Windows:   16,384 bytes
Disk Caching Status
drive   read cache   write cache   buffering
-------------------------------

Write behind data will be committed before command
prompt returns.
For help, type "Smartdrv /?".
```

The cache hits and cache misses numbers show you how many times Smartdrive was able to provide data from its memory cache instead of the computer's having to access the hard drive. To configure Smartdrive properly, divide the cache miss by the cache hit numbers. In this example, there is a 40% cache hit rate.

A hit rate of 70% or higher indicates the proper configuration of the Smartdrive cache program. Test the Smartdrive cache hit-and-miss rate by typing **SMARTDRV /S** frequently during DOS and Windows sessions (in Windows, click on the MS-DOS icon in the Main group to get to the DOS prompt and type the command). Alter the Smartdrive settings in the AUTOEXEC.BAT file to configure the DOS and Windows parameters.

Smartdrive Cache-Clearing Methods

If you save data in an application program or a game, the Smartdrive cache program captures the data and holds it momentarily in memory. To ensure that any unwritten data is written to disk, type **SMARTDRV /C** at the DOS prompt.

To flush the entire Smartdrive cache, both write and read data, type **SMARTDRV /R** at the DOS prompt.

With the Smartdrive program included with DOS 6.2, the Smartdrive read- and write-cached data is written to disk by default in about five seconds. Also, the MS-DOS prompt will not be displayed when exiting from Windows until the Smartdrive cache is flushed. Don't turn off your PC until you see the DOS prompt. This ensures that saved data is written to disk.

Smartdrive Configuration Issues

If Windows displays the error message **Application has caused a General Protection Fault in module KRNL.EXE**, the Smartdrive CD-ROM caching module may have a conflict in memory. You can resolve this by editing the Smartdrive line in the AUTOEXEC.BAT file. Add the /U parameter to the end of the SMARTDRV.EXE line and save the file. Reboot the computer and start Windows.

The /U parameter will prevent the Smartdrive cache program from caching the CD-ROM drive. If Smartdrive is loaded without the /U switch, you can disable or enable caching individual CD-ROM drives using the + or - parameters. For instance, if you want to enable write caching on drive C, type **SMARTDRV C+**. Or you can add the + parameter to the Smartdrive line in the AUTOEXEC.BAT file.

For more information about Smartdrive configuration options, type **HELP SMARTDRV** at the DOS prompt.

CD-ROM Issues

With a CD-ROM drive, you can explore games with video, sound, and animation that are too large to fit on a floppy disk. Unfortunately, CD-ROM drives are the most vulnerable accessories installed on a PC, because their connection to DOS depends on at least *two* device drivers.

In this section you'll learn how to optimize your CD-ROM drive for multimedia games. You'll also learn how to rapidly recover from failed game installations that cripple the drive. Finally, you'll see how to use memory efficiently when CD-ROM device drivers are installed on your PC.

CD-ROM Fundamentals

Floppy and hard disk drives have their device drivers built in the MS-DOS operating system, but CD-ROM drives become operable *only* with the aid of at least two external driver programs. First, a CD-ROM-specific device driver (or drivers) must be loaded in the CONFIG.SYS file. Second, an MS-DOS MSCDEX (**M**icro**s**oft **CD Ex**tensions) program file is installed from the AUTOEXEC.BAT file. This file gives the drive the attributes of a DOS disk drive. MSCDEX can also be launched from the DOS prompt, but it is usually included in the AUTOEXEC.BAT file for convenience.

Essential Tools for CD-ROM Operation

If you want to obtain maximum performance from your CD-ROM drive (and to quickly recover from lost system files or device drivers), you must have the following:

- The *latest* version of your CD-ROM device driver program
- The *latest* version of the MS-DOS file MSCDEX.EXE
- A *printed* copy of your AUTOEXEC.BAT and CONFIG.SYS files

The CD-ROM device drivers come with the PC (if it was purchased with the drive installed) or with the CD-ROM drive installation kit. Most multimedia-ready PCs include a disk backup utility program so you can copy the bundled software

and device driver programs for your add-on hardware (e.g., a sound card, video card, and CD-ROM drive). If you have such a system, back up all the software on the list.

If you installed a CD-ROM drive separately (or had it installed in your PC), it came with a set of installation disks to install the proper device drivers and other programs on your hard drive. Make backup copies of these files if you haven't already. In multimedia kits, which include a sound card and a CD-ROM drive, the CD-ROM device driver is usually included with the sound card driver software. In fact, the sound card acts as a controller board for the CD-ROM drive in these kits.

You need to obtain and *install* the latest version of the CD-ROM device drivers from either the PC, CD-ROM drive, or sound card manufacturer. Their technical support number should be listed in the manual. If not, try one of the manufacturer forums on commercial BBSs. See the reference and online help sections of this book for more details. Check for driver updates about every six months.

Unlike other add-on hardware in your PC (like the mouse), the CD-ROM needs a second program loaded in memory called MSCDEX.EXE, which is included with MS-DOS versions 6 and above. The file is also included with many CD-ROM installation disks. The MSCDEX program allows DOS to recognize and configure your CD-ROM hardware as a disk drive. It works with the driver already loaded in memory and assigns the CD-ROM drive a disk drive letter (usually D).

You should obtain and use the *most recent version* of MSCDEX that is presently available. It comes with the latest release of MS-DOS, or you can download it from the Microsoft BBS. To find out which version of MSCDEX you have, watch your screen during bootup for the version number. You should have version 2.21 or higher. If the screen display scrolls too quickly, do a step-through bootup by holding down the F8 key at startup and processing your system files one line at a time. This step-through process is also educational; you'll see the screen messages that appear when your CD-ROM drivers load successfully.

Check the line in the AUTOEXEC.BAT file that loads the MSCDEX program to see if it originates from the DOS directory. Many installation programs include an older version of the file that is loaded from another directory. If your system is like this, edit the line so the file loads from the DOS directory.

The MSCDEX file must be loaded *before* Windows starts—*not* from a DOS prompt in Windows.

A printout of your CONFIG.SYS and AUTOEXEC.BAT files can save you time, because you'll have the correct information to work with if you need to troubleshoot CD-ROM drive problems. An inoperative drive can be the result of incorrect or missing system files. Editing the files to their original state can bring a CD-ROM back to life.

How Games Can Affect CD-ROM Drives

Many game installation programs alter the settings in the computer's CMOS setup, sound card configuration, and CONFIG.SYS and AUTOEXEC.BAT files. Because of this, a CD-ROM drive is frequently a contributing factor in loading failures.

If you use games and other software applications, a time will come when you cannot access your CD-ROM drive. Assuming your hardware is okay, it isn't difficult to bring it back to life. This is why advance preparation is vital; without backup copies of the CD-ROM drivers and the MSCDEX program, you might be stuck without multimedia capabilities. The following section gives tips for getting up and spinning again.

Recovering from a CD-ROM Crash

- Isolate the problem. First find out whether it's the drive or *the CD in the drive* that has the problem. Is the disk upside down? If the CD must be placed in a caddy, try a different caddy. Clean the disc with a dry, soft cloth from the center to the edge before reinserting it into the drive. Try using other CDs. Do they load alright? If so, it isn't the drive.
- If a Windows CD game won't get through the installation, change to the VGA video driver and reinstall it. Later, change back to the high-resolution driver to run the application. *Before* you install or load a CD-ROM game, make sure you have a CD in the drive.
- If you receive erratic operation from the CD-ROM drive, boot up the computer with a minimum configuration. Using the

F8 step-through, just load the HIMEM.SYS driver, the CD-ROM driver, and the MSCDEX program. Check your system files and see if the CD-ROM and MSCDEX drivers are being loaded into upper memory—check for DEVICEHIGH or LH in those lines. If you find those designations, remove the HIGH or the LH from the line, save the file(s), and reboot.

If the problems cease, there may be a conflict in the upper memory area. You'll have to selectively boot up without certain files loading from the CONFIG.SYS and AUTOEXEC.BAT files to eventually find the conflict. If there is a problem accessing the CD-ROM drive or programs in Windows, try starting Windows in Standard mode—at the DOS prompt, type **WIN/S**.

Also check the lines in your CONFIG.SYS and AUTOEXEC.BAT files for the proper syntax; check spelling, colons (versus semicolons), proper slash marks, and spacing. Delete the CD-ROM and MSCDEX drivers from their directories and copy them from your backup disks into their respective directories.

- If your present version of MSCDEX is version 2.20 or lower, you may need to have the SETVER device driver loaded in the CONFIG.SYS file. Otherwise you may receive an **Incorrect DOS version** message on the screen. This is a sample line for SETVER:

```
DEVICE =C:\DOS\SETVER.EXE
```

- Ensure that your PC is operating at its *fastest* speed (Turbo mode). Don't rely on the Turbo light color (if your case has one) as an indicator. To check which mode you're in, at the DOS prompt, type **DIR** and watch how fast the screen displays the file listing. Then change your PC speed (push the Turbo button or use your manual's recommended key combination for changing speed). Type **DIR** again and compare the speed. Leave the PC in the faster mode.
- If your CD-ROM drive is connected to your sound card, check the setup or configuration program in the sound card program directory. See the sound card manual for details. Make sure the configuration program is loading the CD-ROM device drivers.

- Some owners have their PC cases standing on end. This can cause erratic operation from both the caddy and the tray of internal CD-ROM drives. Position the computer case in the upright position for proper operation.
- If you experience unstable CD-ROM performance, try substituting a new data cable from the back of the drive to its controller card (or to the sound card). The data cable will have 40 or 50 thin wires inside, and if just one of them is making a poor connection (or if the cable is stretched to its physical limit), you will get erratic operation from it.
- If Windows displays the error message **Application has caused a General Protection Fault in module KRNL.EXE**, the Smartdrive CD-ROM caching module may have a conflict in memory. To alleviate this problem, you need to edit your CONFIG.SYS file by adding the /U parameter to the end of the SMARTDRV.EXE line and then restart your computer

  Suppose that Smartdrive is already running and you want to enable write caching on drive C. To do this, type **SMARTDRV C+** at the command prompt.

  Suppose you want to configure Smartdrive to disable all caching of your floppy disk drives and enable write caching on Interlnk drive D. (Interlnk drives, like floppy disk drives, are not write-cached by default, because it's possible to lose access to the drive before all information has been written from the cache.) To do this, you would add the following command to your AUTOEXEC.BAT file:

```
C:\DOS\SMARTDRV A- B- D+
```

  The /U designation prevents Smartdrive from automatically loading the CD-ROM caching module. If Smartdrive is loaded with the /U switch, you cannot enable CD-ROM drive caching. If Smartdrive is loaded without the /U switch, you can disable or enable caching individual CD-ROM drives using the + or - parameters.
- If the CD-ROM cannot be accessed from Windows and doing a DIR command at the DOS prompt gives the error message **EMM no longer valid, CDR 102**, check the MSCDEX.EXE line in the AUTOEXEC.BAT file. If the line has a /E in it, remove the /E, save the file, and reboot the computer. Loading the MSCDEX into conventional memory will also solve this problem.

How Your PC Loads CD-ROM Drivers

When your computer boots up, it checks for a diskette in drive A and then it accesses drive C. If your hard drive has a CONFIG.SYS and AUTOEXEC.BAT file in its root directory (C:\), DOS will install the drivers and programs listed there. The CONFIG.SYS file is processed first. For your CD-ROM drive to work, there must be a device driver line (or possibly two lines) in CONFIG.SYS. One of the lines will refer to the CD-ROM's device name—MSCD0001, for example. These are typical CD-ROM device driver lines:

```
DEVICE=C:\CDROM\DRIVERS\DOS.SYS /D
DEVICE=C:\CDROM\DRIVERS\CD.SYS /D:MSCD001
```

And this is an example of an accompanying MSCDEX line in the AUTOEXEC.BAT file:

```
C:\DOS\MSCDEX.EXE  /D:MSCD001
```

Notice that the device name, MSCD001, is the same in both system files. This is important because both designations refer to the specific CD-ROM name for DOS will recognize.

If your CD-ROM drive is connected to a sound card inside your PC, there will usually be a single device line in the CONFIG.SYS file. This is a sample CD-ROM drive line loaded by a sound card in CONFIG.SYS:

```
DEVICE=C:\MMP16P\DRIVERS\CDMKE.SYS /D:MSCD0001
```

The accompanying line in the AUTOEXEC.BAT file appears as follows:

```
C:\DOS\MSCDEX.EXE /D:MSCD0001
```

Your MSCDEX line may have extra parameters at the end. To see a complete explanation of them, at the DOS prompt, type **HELP MSCDEX**.

CD-ROM Error Messages

This section lists some of the messages that may appear on your screen when DOS tries to load the MSCDEX program or during a program installation. I've included a short explanation of their meaning and possible solutions.

Device driver not found CD *xx*—no valid CD-ROM drivers selected The CD-ROM device driver failed to load, or its device name (e.g., /D:MSCD001) doesn't match the name given at the end of the MSCDEX program line. Check the system files for proper syntax. Enter **CHKDSK/F** at the DOS prompt to check for a corrupted file. You may have to delete and reinstall the CD-ROM and MSCDEX drivers and reboot.

Error in CONFIG.SYS (or AUTOEXEC.BAT) line xx. driver not found The CD-ROM driver or MSCDEX program for the CD-ROM drive were not found in the directory locations listed in the system files. Check the directories for the files and reinstall them if necessary.

Not enough drive letters available If your PC has a network card *or* more than one hard disk installed (or a hard drive with multiple partitions on it with more than one drive letter), or if the hard drive is running a compression program, you need to check for a LASTDRIVE line in the CONFIG.SYS file. By default, MS-DOS will reserve five drive letters for your system.

When MSCDEX is finally loaded from the AUTOEXEC.BAT file, all of the available drive letters may already be in use by your hard drive partitions, a network card, or a Stacker or Doublespace drive.

To see how many drive letters you'll need, at the DOS prompt, type drive letters from D on up until you get an error message. (e.g., type **D:** and press Enter, then **E:** Enter, etc.). Note which drive letter results in an **Incorrect drive specified** message. Use that drive letter designation in CONFIG.SYS' LASTDRIVE statement. Here's an example line:

```
LASTDRIVE=J
```

CDR101 not ready reading drive D This message indicates that the CD-ROM drive is having a problem reading data from the disk (assuming one is in the drive). Check the obvious possible problems first: Ensure that a CD-ROM *program* disk is in the drive (not an audio compact disc); see if the drive light comes on when you do a directory listing of the drive, clean the disk, and check to make sure the CD caddy (if installed) is completely closed and free of foreign objects. If that doesn't solve the problem, see if

another CD program disk can be read by the drive. If so, switch the CD-ROM caddies.

CDR102: EMS memory no longer valid A memory conflict between programs may have occurred in the upper memory area. Try rebooting the computer and check it again. Or do a minimal selective bootup until you find the conflicting driver program. If your CD-ROM drivers are loading high, load them into conventional memory (remove any HIGH or LH statements from the system file line(s)).

CDR103: CD-ROM not High Sierra or ISO 9660 The CD may not be a DOS or Windows-formatted compact disk. Check the format type with the manufacturer.

CDR104: CD-ROM door is open Close the CD-ROM door or check the caddy (if installed) and see if it is fully closed.

Increasing the Performance Of Your CD-ROM Drive

Even though CD-ROM drives are expected to be much slower than hard disks, there are a few ways to increase their performance.

The Smartdrive disk-cache program included with DOS 6.2 can cache CD-ROM drives. This allows data read from the CD to be stored in memory temporarily in case it's needed later. If your AUTOEXEC.BAT file has a Smartdrive line, it will cache the CD-ROM drive automatically—as long as the Smartdrive line is placed *after* the MSCDEX line. You don't have to do anything else! If the Smartdrive line is placed before the MSCDEX line, it will not know that there is a CD-ROM drive device installed in your system. This typical AUTOEXEC.BAT file will cache the CD-ROM drive:

```
@ECHO OFF
PROMPT $P$G
PATH C:\DOS;C:\WINDOWS;C:\
LH C:\DOS\MSCDEX.EXE /D:MSCD0001 /M:30
C:\DOS\SMARTDRV.EXE 1024 256
WIN/3
```

Notice that there is a /M:30 at the end of the MSCDEX line. This concerns the next performance tip.

The /M statement (or switch) tells MS-DOS to reserve sector buffers (memory areas) for data that the drive loads from the CD. This is similar in operation to the Smartdrive disk cache. With no /M switch at the end of the line, MSCDEX will have six buffers assigned to it. Each buffer requires 2K of memory. The higher the number, the more memory is used by the MSCDEX program. If the file is already loaded in upper memory with the LH statement, it will not affect your conventional memory area.

By assigning different numbers after the /M switch, you can test CD-ROM drive access times with one of your graphic-intensive games. After each number alteration, check the amount of conventional and upper memory free.

In some instances, the MSCDEX program isn't loaded into upper memory and the buffer number will affect your conventional memory free. Knowing this, you can sometimes reduce the number assigned to load a game when your system is just a few kilobytes short of loading.

Using the /E switch at the end of the MSCDEX line will load the sector buffers into expanded memory. Here is an example line:

```
LH C:\DOS\MSCDEX.EXE /D:MSCD0001 /M:30 /E
```

If the EMM386.EXE line in the CONFIG.SYS file has a RAM designation, your computer is using extended memory to *emulate* expanded memory.

Since DOS 6.2 provides extended memory to be used as expanded memory, the sector buffers are actually being loaded into extended memory—the memory area above 1 MB. This method will free up upper memory space, allowing other drivers and TSRs to load there.

Part 7

Disk Compression Issues

Compressing a hard disk drive to gain storage space is a tempting option; especially since DOS 6 (and above) comes with a free compression program—either Doublespace or Drivespace. Since games are growing in size—some of them take up as much as 40 megabytes (MB) of disk space!—many users feel they have no choice but to compress their hard disk drive to gain storage space.

In this section, you'll learn the advantages and disadvantages of using disk-compression software and how to troubleshoot problems with the DOS 6 Doublespace and Drivespace programs and the various STAC Electronics Stacker programs.

You'll also learn installation techniques, for the DOS 6 Doublespace and Stacker compression programs in particular. You'll see how a compression program changes your computer's memory configuration and speed. System file editing and recovery techniques are also discussed.

This chapter is *not* a comprehensive guide to compression software; it only covers the basics. Always refer to the compression software manufacturer's manual and technical support line for installation and configuration questions or problems.

The Basics of File Compression

How File Compression Works

To understand how compression programs work, you need to know how information is normally stored on disk drives. In a word-processing file, for example, every character and space saved in the file requires one byte of disk space. All of the bytes, and a few more that hold file identification information, are stored on a disk as a data file.

The DOS operating system doesn't keep track of every single byte of data on the disk. Even if you have a file that contains only *one* character (which should indicate that it will only be one byte in length plus a few more for file identification information), the file will probably take up two, four, or even eight thousand bytes of disk space!

A disk drive—floppy or hard drive—is made up of circular tracks. These tracks are divided into sectors. With an MS-DOS formatted disk, a single sector contains 512 bytes. A group of sectors is called an *allocation unit,* or a *cluster.* The smallest form of data that the MS-DOS operating system keeps track of is an allocation unit. To check the sectors per allocation unit on a disk, at the DOS prompt type **CHKDSK**. You'll see a complete listing of sector size, disk space, and more data. This is a typical CHKDSK information listing:

```
141246464 bytes total disk space
5324800 bytes in 3 hidden files
495616 bytes in 114 directories
131858432 bytes in 2390 user files
3301376 bytes available on disk
4096 bytes in each allocation unit
34484 total allocation units on disk
806 available allocation units on disk
655360 total bytes memory
484960 bytes free
```

The listing states that each allocation unit consists of 4096 bytes (4K). That equals eight 512-byte sectors per allocation unit. All of this information is presented to show you how much wasted space is on every disk you use. If you have a lot of data files with less than two thousand characters in them, they take up 4 thousand bytes of disk space. You may wonder why DOS

uses a seemingly wasteful system like this. The reason is speed. If DOS had to keep track of every single byte of data, it would take an extremely long time to search and write data to the disk. The allocation unit is the smallest amount of data that DOS keeps track of. Even if a small file only required one sector of disk space (512 bytes), DOS assigns one allocation unit (8 sectors in this case) to the file. Compression software can work with even tinier amounts of data to save valuable disk space.

Most files have repetitive information, such as spaces and repeated character groups, that can be represented in an abbreviated form to conserve storage space. This method is used by compression programs to store files on disks.

For example, the following sentence can be represented and understood in two ways:

> This is a misunderstood prism that isn't an anachronism.
>
> "Th! ! a m!understood pr!m that !n't an anachron!m.

The two letter sequence *is* is repeated several times in the first sentence. By substituting an exclamation mark (called a "token character" in compression terminology) to represent them saves space in the file. Of course, you must have some type of file scanning and *organizing* system set up to check files, look for redundancy, replace characters with tokens, keep track of token equivalencies, and rewrite and save the files. This process is repeated every time the program files are retrieved from the disk, loaded into memory, and written back to the drive!

Using the PC-as-house analogy introduced in the "Memory Issues" section, the game program files are the entertainers (singers, dancers, band, crew, and management personnel, musical instruments, and equipment) that reside in the guest rooms (hard drive storage area) until needed. The guest rooms have limited space to house the entertainers, crew, and equipment. Normally the rooms are equipped with beds and a closet. The compression software can be thought of as a *room organizer* who checks a room's potential occupant list and equipment list. He makes records of the information and then installs bunk beds, shelves, and closet organizers so more people and equipment can fit comfortably in the room. In other words, a typical bedroom wastes a lot of space, just as an uncompressed hard drive does, and, like a room organizer, a disk compression program can free up space.

The records that the room organizer keeps are crucial. Without them the entertainers couldn't fit into the rooms, because in this system, *organization is critical.* Compression software essentially converts all of the compressed software files into a form that MS-DOS *does not recognize* (called a **C**ompressed **V**olume **F**ile—**CVF**). You are *totally dependent* on the compression software program files to make your system work. These program files must always be loaded into memory whenever you need access to the compressed files. Remember the old saying about putting all of your eggs in one basket?

Your hard disk drive C will be changed when compression software is installed. At first, the hard drive just contains a few fundamental DOS files, the compression program files, and one large file, which is the rest of the hard disk programs you've installed. After completing the bootup procedure, the large compressed file is then "remapped" to represent the C drive, and the uncompressed portion of the hard disk (the host drive) is remapped as the D or H drive. If something happens to the compression program files, you won't have access to the rest of your application programs and games.

Is Compression Software Good for Games?

Since games contain extremely large files for sound and high-resolution animation screens, most of them already use file compression/decompression techniques. When the PC's compression program encounters game files, it may *waste* time trying to compress the information, which is already compressed.

Using compression software on word-processing files, you can achieve nearly a 15 to 1 compression ratio. Game file compression results in an average 1.3 to 1 ratio.

If your hard drive is already compressed, you can install a game program on both the host (uncompressed) and compressed drives and test the speed difference.

Doublespace and Drivespace Compression Programs

If you've already installed the DOS 6 Doublespace or Drivespace compression software, read this section for important safety and recovery tips. Much of the information given is undocumented and can save you from losing your valuable personal and program files needlessly.

If you haven't installed Doublespace yet, read on before you do. You should back up all the files on the hard drive, do a virus check, and defragment the hard disk *before* proceeding. See the "Storage Issues" section for more details.

Doublespace (and Drivespace, included with DOS 6.22 and up) is a unique compression utility program: When it is installed, it's incorporated into the MS-DOS operating system. The CONFIG.SYS and AUTOEXEC.BAT files will not be altered or need special attention in editing. There may be a line added to the CONFIG.SYS file that states:

```
DEVICE=C:\DOS\DBLSPACE.SYS /MOVE
```

It isn't necessary for the compression program to run. DBLSPACE.SYS will attempt to load the Doublespace device driver (DBLSPACE.BIN) into upper memory if there is an upper memory block with at least 50K of memory free.

When Doublespace is installed, it adds two files to the root directory, DBLSPACE.BIN and DBLSPACE.INI. The DBLSPACE.BIN file *is* the Doublespace program. The DBLSPACE.INI file is a file that configures the DBLSPACE utility. If either of these files are corrupt or if they are not located in the hard drive's root directory (C:\), the Doublespace compression program will not load and there will be no access to the compressed drive. The compressed drive file is usually named DBLSPACE.000; it contains all of the files on the hard disk drive.

The DOS 6.22 Drivespace compression program uses the same functions and commands as the DOS 6 and 6.2 Doublespace program. If you have Drivespace installed, substitute references to Doublespace filenames with Drivespace filenames. For example, the command DBLSPACE.SYS can be performed as DRVSPACE.SYS with DOS 6.22.

How Games Affect the Doublespace Program

A failed game installation can result in files being lost from the root directory. Defragmenting or backing up the hard drive files can sometimes ruin important startup files. The important

Doublespace program and initialization files (DBLSPACE.BIN and DBLSPACE.INI) reside there, and if they become damaged or deleted, the computer will not load the compression program.

Without the Doublespace program installed, your computer will boot up to the C drive with no access to the previously compressed files. Performing a DIR listing at the DOS prompt will display only about 2 MB of hard drive space available. If you type **DIR,** (the final comma makes the directory listing display hidden files as well), you'll see a few more hidden files, including a large DBLSPACE.000 file, which is the compressed volume file.

See the tips at the end of this section for Doublespace recovery procedures.

Booting Up Without Doublespace

With DOS version 6.2 and above, you have the option to boot up without the Doublespace program running. Some MS-DOS games that write information directly into video RAM can cause problems with the Doublespace program. Doublespace needs to hold a small section of information in memory so that it can later expand a compressed section of data. When a game is writing directly to the video RAM area, it makes this section of memory *unavailable* to Doublespace. Problems with screen graphics result from this conflict.

The non-Doublespace bootup option can come in handy for the following situations:

- You are having problems with the Doublespace program files causing the computer to hang at bootup time.
- You need more memory available because the DBLSPACE.BIN file is not loading into upper memory.
- You wish to run programs stored on your hard drive's uncompressed host drive (there are some programs that won't run properly under Doublespace, or they run too slow).

To boot up without Doublespace loading, just hold down the Ctrl key and the F8 or F5 key at bootup time. When you bypass Doublespace, you won't have access to the CONFIG.SYS and AUTOEXEC.BAT files, because they are on the compressed

drive. You can copy your system files from the compressed drive to the uncompressed drive (H) before you bypass Doublespace, or you can copy new versions of the files there. You'll also need any programs or device driver files on the uncompressed drive.

Pressing Ctrl+F8 allows you to process the CONFIG.SYS and AUTOEXEC.BAT files one line at a time. Pressing Ctrl+F5 bypasses the system files completely.

The computer will not have access to any of the compressed files on the Doublespace drive during this session. If you have to correct a problem with the Doublespace files, you can copy them from your DOS setup or backup diskettes to the root directory of your hard drive.

Memory Problems with Doublespace

The Doublespace program uses 34 to 43 kilobytes (K) of memory. The DOS 6 version of Doublespace requires 43K. The DOS 6.2 version uses only 38K. If you include the command DBLSPACE/AUTOMOUNT=0 in the CONFIG.SYS file, Doublespace will only use 34K of RAM. You'll save memory in this mode, but Doublespace will not automatically mount (or access) compressed floppy disks. You have to manually mount any compressed disks before they can be accessed.

Depending on the memory configuration of your PC, the DBLSPACE.BIN program may not be able to load into the upper memory area. First, ensure that the CONFIG.SYS file has this line in it:

```
DEVICEHIGH=C:\DOS\DBLSPACE.SYS /MOVE
```

If you don't see this line in CONFIG.SYS, add it, save the file, and reboot the computer.

Be sure that the DEVICE= statement has the HIGH designation. Otherwise, the Doublespace program will not be loaded into the upper memory area.

You can check the programs loading in conventional and upper memory with the MEM/C/P command. If the DLSPACE.BIN file does not load into upper memory, you'll have to perform some of the techniques found in the "Memory Issues" chapter.

Doublespace and Windows

Windows works okay with Doublespace. The only issue to be concerned about is the Windows swapfile. Windows uses it to temporarily unload programs onto the hard drive when available memory gets low. It then swaps the information back into memory when the program is needed by the user.

The Windows swapfile must be on the uncompressed (host) drive. If Windows is already installed on the hard drive *before* Doublespace is installed, the swapfile will remain on the uncompressed drive while the Windows program files will be stored on the compressed drive. If Windows is installed *after* Doublespace is installed, you will receive a "corrupt swapfile" message when you try to start Windows.

One other important thing to remember: Doublespace will only recognize *one* copy of Windows on the system when it installs. It will keep the swapfile (and the swapfile's location info), which belongs to one copy of Windows, on the host drive. Any other copies of Windows on the hard disk *will not* be altered, and you'll receive the "corrupt swapfile" message when they start.

To correct this situation, check the size of the host drive. Enter the Doublespace program (enter **DBLSPACE** at the DOS prompt), and from the Drive menu, choose Change Size. You'll see a listing of the host and compressed drive letters, along with their present sizes. For each copy of Windows on the hard drive, you should make room for at least 5 MB of swapfile space on the host drive. Once the changes have been completed, exit the Doublespace program.

Next, start each Windows program that gives the error message. From the Windows Main group, double-click on Control Panel. Choose the 386 Enhanced icon. From there, click on the Virtual Memory button. The next screen will show the size and location of the present swapfile. Delete the current swapfile and create a new, permanent one on the host drive with the size you prefer.

Recovering from Lost Doublespace Files

If you boot up your computer and Doublespace doesn't load, there is a way to make the program recognize the compressed volume file. First, look at the file listing in the root directory of the hard drive. Enter **DIR,** (include the comma)at the DOS

prompt. If you see a DBLSPACE.000 file listed that is about the size of your entire hard disk, then the compressed volume file is still complete.

If you do not see the DBLSPACE.BIN file listed, you'll have to copy it from your DOS 6 diskette to the root directory. Put the proper DOS disk in drive A, type **A:**, and press Enter. Then type **COPY DBLSPACE.BIN C:** and press Enter.

The last step is to copy the DBLSPACE.INI file to the hard drive's root directory. You should have already copied it to a diskette for emergencies like this. If you have an emergency diskette, copy DBLSPACE.INI from the disk with by entering this command at the DOS prompt: **COPY DBLSPACE.INI C:**. If you don't have a copy of the file, you can create one easily at the DOS prompt.

To create a basic DBLSPACE.INI file, change to the root directory of the hard disk. If you are at the **A:** prompt, type **C:**, and press Enter. Then type **CD** and press Enter. To create the file, at the DOS prompt enter **COPY CON DBLSPACE.INI**. You'll see a small blinking cursor on the next line. Then type in the following lines (press the Enter key at the end of each line):

```
MaxRemovableDrives=2
FirstDrive=D
LastDrive=I
MaxFileFragments=114
ActiveDrive=H, C0
F6
```

You should get the message **One File Copied** when you're finished. Reboot the computer. Your Doublespace drive should now be recognizable to the computer.

What the DBLSPACE.INI Lines Do

The DBLESPACE.INI file is an initialization file: The DBLESPACE.BIN file refers to it to locate and configure the compressed drive. The following information will help you understand how the file works and how you can modify your version if necessary.

- The first line, MaxRemovableDrives=2, allows for 2 removable drives in the PC.
- The second line, FirstDrive=D, is the first available drive that Doublespace is allowed to use. If your PC needs the D drive for a hard disk or CD-ROM drive, use E or above.

- The third line, LastDrive=I, sets the number of drives for the present configuration. This line should not be higher than normal (don't make it *Z*, or startup errors may occur). If your screen displays a "too many block devices" error message, try a different letter in the LastDrive statement, save the file, and reboot the PC.
- The fourth line, MaxFileFragments=114, tells Doublespace to allow for a certain level of file fragmentation before it will load. If there are more fragmented files, the program will not load to prevent further problems.

If Doublespace fails to load and informs you that the compressed volume file is too fragmented, you can increase the number, save the file, and reboot. You should run a disk optimize utility program that can work on compressed drives to fix the problem.

- The fifth line, ActiveDrive=H, C0, is the most important. It specifies the new host drive letter (H), the compressed drive letter (C), and the number of the DBLSPACE.000 file. (You only need to include the last number in the filename. If your filename ends with a different number, use that instead.)
- The F6 line informs DOS that it has reached the end of the file and instructs DOS to save it.

Doublespace Uninstall Procedures

Doublespace comes with two ways to easily reverse its installation. From the DOS prompt you can type **DBLSPACE/UNCOMPRESS C:**. Or you can start the Doublespace program (enter **DBLSPACE** at the DOS prompt) and choose the Uncompress option from the Tools menu.

To uninstall Doublespace, you must have enough room on your hard disk to store the uncompressed files. If the compressed drive is filled with more files than the *physical* hard drive can hold, you'll have to save the files to diskette and delete them from the Doublespace drive to decrease its size. Or you can use the Doublespace Change Size option to make the Doublespace drive smaller and the uncompressed host drive larger. Then you can copy files from the compressed to the uncompressed drive and later delete the files from the compressed drive.

Doublespace Hints and Tips

- Make a boot diskette for emergencies so you can boot from drive A and still have access to your Doublespace drive. With a formatted disk in drive A, at the DOS prompt type **SYS A:**. The floppy disk also needs a DBLSPACE.INI file in its root directory so the Doublespace program will be activated at bootup time. From the hard drive's root directory, type **COPY DBLSPACE.INI A:**.
- If the fundamental MS-DOS files are not found in the hard disk's root directory, the computer cannot boot at all. To alleviate this situation, boot up from the DOS 6.2 floppy disk and at the A prompt, type: **SYS C:**. The SYS command will copy the crucial DOS files—IO.SYS, MSDOS.SYS, COMMAND.COM, and DBLSPACE.BIN—to the root directory of the hard drive.
- The Doublespace drive needs to be defragmented on a regular basis to keep the access time low. Use the **DBLSPACE / DEFRAGMENT /F** command at the DOS prompt.
- Familiarize yourself with the various DOS 6.2 SCANDISK, CHKDSK, and DBLSPACE commands by entering **HELP** at the DOS prompt. You can highlight the command of your choice to see all of the definitions and syntax examples. These utility programs will help you maintain a smooth-running compressed drive.
- To check the compression ratio of files, type **DIR/C**. You'll see the ratio listed after the file's last save time and date. Type **HELP DIR** to learn about more directory command options.
- The Doublespace program has its limits. It can only compress a drive with less than 512 MB of data. If your hard disk has more data than this, you'll have to save the files to diskette or delete them until your total amount is less than 512 MB.
- When you back up files on your hard drive, back up the files and directories on the compressed hard drive. Do not back up the compressed volume file on the host computer (DBLSPACE.000). In this manner, you can restore individual directories and files instead of the entire compressed hard drive.

- If the computer becomes unbootable after you use Microsoft Backup or Microsoft Backup for Windows, use the emergency boot diskette to restore the root directory files; boot up from the A drive and enter **SYS C:** at the DOS prompt. Using the default settings of Microsoft Backup will not replace the critical IO.SYS and MSDOS.SYS files at their proper locations in the root directory. Using the SYS C: command restores the files to their proper locations.
- If you format a diskette from the Windows File Manager, the disk may not be bootable because the DBLSPACE.BIN file is not copied to it. Copy the file to the disk from the File Manager or at the DOS prompt. The file is located in the DOS directory and in the hard drive's root directory (if Doublespace is installed).
- Before you format a floppy disk, access it first by typing its drive letter (e.g., **A:**). Then type **Format A:** (or **Format B:**). This ensures that the drive will be formatted in the Doublespace format.
- Doublespace must be able to write to the diskette in order to access it. To mount a compressed diskette, the write-protection tab on the diskette must be removed or the write-protect window must be closed.
- If you've uncompressed the hard drive and the DBLSPACE.BIN and DBLSPACE.INI files are still located in the root directory (C:\), the DBLSPACE.BIN will load at bootup time, occupying 34K to 43K of memory. To fix this situation, use the Windows File Manager or DOSSHELL to delete both Doublespace files from the root directory. These files may be hidden and read-only, so you'll have to remove those attributes from the files before they can be deleted. Use the Help menu for information about file attributes.
- When using a virus-checking program such as the DOS 6 MSAV utility, be sure to scan both the host and the compressed drives.

Stacker Issues

This section gives an overview of how the Stac Electronics Stacker disk-compression program makes changes to your system files. It is intended for users who have already installed Stacker.

For a complete understanding of the program, *see the Stacker manual* for more details. Since Stacker adds device driver lines in the CONFIG.SYS file, it is important to understand their purpose. Otherwise you might inadvertently modify or delete them and lose access to the compressed Stacker drive.

Before using Stacker, always read its manual thoroughly, and first back up all of your program files and defragment the hard disk. For more information on Stacker and advanced troubleshooting techniques, contact Stac Electronics at the phone number given at the end of this book section.

The following discussion presumes that Stacker was installed and it was used to compress an entire hard disk drive designated as C. Substitute your compressed drive letter if different than C.

There are two different types of Stacker programs. Stacker versions 1, 2, and 3 use the same program-loading procedure. Stacker versions 3.1 and 4.0 and Multimedia Stacker use *a completely different* method of loading on your PC. See the appropriate section for detailed information about your installed Stacker compression program.

How the Stacker Program Works (Versions 1, 2, and 3)

After the Stacker program is installed, it compresses the hard disk contents into a compressed volume file called STACVOL.DSK, which it stores under the root directory of the host hard disk. Stacker then copies the program file, STACKER.COM, and the drive-swapping file, SSWAP.COM, to the host drive (uncompressed drive). The line in the CONFIG.SYS that loads the Stacker program will look similar to this:

```
DEVICE=C:\STACKER\STACKER.COM C:\STACVOL.DSK .
```

When the computer boots up, this line will load the STACKER.COM device driver from the C:\STACKER directory. The C:\STACVOL.DSK file is the compressed volume file (the compressed hard disk). The compressed drive is accessed and assigned the next-highest drive letter (usually D).

The next line in the CONFIG.SYS file will swap the host (uncompressed) hard drive and the compressed hard drive letters automatically:

```
DEVICE=C:\STACKER\SSWAP.COM C:\STACVOL.DSK/SYNC
```

Editing or deleting these lines may result in loss of access to the Stacker compressed drive.

The swapping process is necessary, because all of the hard drive programs, games, AUTOEXEC.BAT files—*everything*—is on the compressed drive. The computer has *two* CONFIG.SYS and AUTOEXEC.BAT files on it—one copy on the host and one copy on the compressed drive. After the compressed drive is accessed (mounted) and the drive letters are swapped, the computer continues to process the remaining CONFIG.SYS file lines and proceeds to process the AUTOEXEC.BAT file lines (both are on the compressed drive).

The SYNC designation tells Stacker to keep track of each CONFIG.SYS and AUTOEXEC.BAT file and to inform the user of any changes to them.

Here are a few important facts to consider when using Stacker:

- The normal DOS files and Stacker device drivers must be located on the host drive for the PC to be bootable and for you to have access to the compressed hard drive: IO.SYS, MSDOS.SYS, COMMAND.COM, STACKER.COM, SSWAP.COM, and all of the device drivers mentioned in the CONFIG.SYS *before* the STACKER.COM line (e.g., HIMEM.SYS, EMM386.EXE, etc.).
- The Stacker program will monitor changes made to the CONFIG.SYS and AUTOEXEC.BAT files. After editing these files and rebooting the computer, you'll see a screen message that begins: **Stacker has detected changes in the following files(s):** You'll see which system file has changed, including the line number. You can then have Stacker automatically copy the changes to the host drive's system file.
- If a driver or program is not located on the proper drive, you'll receive a message such as **Bad or missing driver** or **Error in CONFIG.SYS line xx**. You'll have to copy the driver or program file to the proper directory on the host (D:) drive.

- To conserve conventional memory, the STACKER.COM file can be loaded into upper memory. Edit the file line to read like this:

```
DEVICEHIGH=C:\STACKER\STACKER.COM
```

  The SSWAP.COM file is not memory-resident and doesn't need to be loaded high.

- Before using a commercial memory manager program like QEMM, 386MAX or NetRoom, check with the product's tech support staff for details about using Stacker.

- To defragment the Stacker compressed drive, use only the SDEFRAG program that comes with Stacker. You can use any disk optimizer software to defrag the host (uncompressed) drive.

- The Windows swapfile must be located on the host (uncompressed) drive. When Stacker installs, it relocates the swapfile to the host drive. If a new copy of Windows is installed *after* Stacker is installed, you must place the swapfile on the uncompressed drive (usually D). From the Windows Main group, double-click on Control Panel. Choose the 386 Enhanced icon. From there, click on the Virtual Memory button. The next screen will show the size and location of the present swapfile. Delete the current swapfile and create a new, permanent one on the host drive with the size you prefer.

- If you use a disk-cache program like the DOS Smartdrive, cache *just* the host drive, not the Stacked drive. For instance, to set Smartdrive to cache the host drive D, and not C (which is the compressed drive), use the following parameters on the Smartdrive line:

```
C:\DOS\SMARTDRV.EXE C- D
```

  The C- part of the line makes Smartdrive *not* cache the C drive.

- When you install Stacker, the drive letter designations will change on your system. This may present a problem for an installed CD-ROM drive (or one that is installed later), which is usually referred to as drive D. You can run the Stacker program and alter the drive letter of the host drive to alleviate this situation. See your Stacker manual for more details.

- *Note to owners of Stacker version 2:* Stacker version 3 and above includes the option to use the UNSTACK command to reverse the installation process. It will uncompress the drive and return it to its original state. See the Stacker manual for more details.
- To see the compression ratio of files on the Stacked drive, type: **SDIR** at the DOS prompt. You'll see a normal directory listing of the directory's filename, size, date, and compression ratio.
- Stacker version 3 includes the UNSTACK command to uncompress a Stacked drive. There must be enough room on the uncompressed host drive to contain all of the compressed files from the compressed drive before the uncompression routine can proceed. To check for disk-space size requirements before using the UNSTACK command, you can use the CHECK command first. At the DOS prompt, enter **CHECK /D**. This will give you detailed information about the compressed drive. If your Stacked drive has another drive letter, F for example, put that drive letter and a colon after the CHECK command: **CHECK F: /D**.

  To unstack a Stacker compressed drive, you can type **UNSTACK C:**. (If your compressed drive has a different drive letter, substitute that letter after the UNSTACK command.)

Booting Up Without Stacker Versions 1, 2, or 3

On some sessions you may want to boot up without the Stacker program running. Here are some reasons to boot up without Stacker:

- You are having problems with the STACKER.COM file causing the computer to hang at bootup time.
- You need more memory available because the STACKER.COM file is not loading into upper memory.
- You wish to run programs stored on your hard drive's uncompressed host drive (D).
- To boot up without Stacker loading, just press the F8 or F5 key at bootup time. The F8 key will allow you to process the CONFIG.SYS and AUTOEXEC.BAT files one line at a time. If you bypass the two Stacker file lines, the compressed drive

will not be accessed and the drive letters will not be swapped. You will only have access to files and programs on the host (uncompressed) drive during that session.

- Pressing the F5 key bypasses processing the CONFIG.SYS and AUTOEXEC.BAT files completely. The compressed drive will not be accessed and the drive letters will not be swapped. You will only have access to files and programs on the host (uncompressed) drive during this session. The computer will not have access to any of the compressed files on the Doublespace drive during this session. If you have to correct a problem with the Doublespace files, you can copy them from your DOS setup or backup diskettes to the root directory of your hard drive.

How the Stacker Program Works (Versions 3.1 and 4.0 and Multimedia Stacker)

The Stacker loading method *changed radically* starting with version 3.1. To use the newer version, MS-DOS 6 became a requirement to install the program. In fact, versions 3.1 and higher use the DOS 6 DBLSPACE.BIN automatic-loading capability to install the Stacker program file! Owners of Stacker versions 3.1 and 4.0 should read the previous section for an overview of the DOS 6 Doublespace program and then read this section carefully to learn about the Stacker bootup process.

Multimedia Stacker uses the same compression system as version 4.0. It is available on diskette or CD-ROM. It also includes a memory manager program that can load some device drivers into the extended memory area, providing more free conventional memory. The discussion of Stacker 4.0 in this section applies equally to Multimedia Stacker.

With DOS 6 and above, the first file loaded is the hidden DBLSPACE.BIN file. This file starts the fundamental bootup process. It searches for the DBLSPACE.INI file for initialization instructions. The compressed drive name and other information is designated in this file. If the information is valid, the compressed volume file is mounted. If the DBLSPACE.INI file is not in the root directory (or if it is corrupt or invalid), the DBLSPACE.BIN file will be erased from memory and no Doublespace drives will be accessed (mounted).

The next file loaded is the MSDOS.SYS file. Then the IO.SYS file searches the root directory for the CONFIG.SYS file. If it's there, it loads the program device drivers and sets the DOS environment accordingly. The DOS COMMAND.COM file is loaded next (if the PC is using MS-DOS as its operating system). Last, the computer processes the commands listed in the AUTOEXEC.BAT file.

Using this loading routine, DOS loads the compression program and creates the drive letters for the host and compressed drives *before* the CONFIG.SYS file is loaded. Therefore, no accidental alterations in the CONFIG.SYS file could produce a Doublespace malfunction.

There is a DBLSPACE.SYS file in CONFIG.SYS, but its purpose is to move the DBLSPACE.BIN file from conventional memory into the upper memory area.

Stacker 3.1 and 4.0 take advantage of the DOS 6 bootup routine to load the Stacker program driver into memory *before* the CONFIG.SYS loads (presumably to stop malfunctions caused by users or by accidentally deleted system files). The Stacker program file, called STACKER.COM in versions 1, 2, and 3, is now named DBLSPACE.BIN.

The Stacker DBLSPACE.BIN file is *not* the same file that comes with DOS 6. It is similar to that file in name only. Since the computer searches for the DBLSPACE.BIN file and loads it into memory, Stacker took advantage of this fact to load its own program in the same fashion. DOS does not check the validity of the file, just the name and location; it must be located in the root directory.

Here are some important facts to consider when using Stacker versions 3.1 and 4.0:

- The Stacker 3.1 DBLSPACE.BIN file length is 57510 bytes. The DOS 6.0 DBLSPACE.BIN file length is 51214. The DOS 6.2 DBLSPACE.BIN file length is 64246. MS-DOS versions 6.21 and 6.22 do not include a DBLSPACE.BIN file. I mention this information so you *will not delete* the Stacker DBLSPACE.BIN file from the root directory, mistakenly thinking it is unnecessary.

- Using the SYS C: command could be dangerous. This command, used at the A: prompt, will transfer all of the crucial DOS startup files to the hard disk's root directory, including IO.SYS, MSDOS.SYS, COMMAND.COM, and DBLSPACE.BIN (the DOS version of this file). When you reboot the computer, your Stacker compressed drive will not be mountable until the Stacker DBLSPACE.BIN file is copied from the installation disk to the root directory.
- When the Stacker DBLSPACE.BIN file is loaded into memory, it is programmed to search the root directory for the STACKER.INI file. This file provides the location of the Stacker subdirectory and the name of the Stacker compressed-volume file (usually called STACVOL.DSK). The compressed drive is then mounted and DOS proceeds to load the CONFIG.SYS file. The STACKER.INI file serves the same function as the DBLSPACE.INI file does for Doublespace: It includes compressed volume file location and drive letter information.
- The CONFIG.SYS file may have a STACHIGH.SYS file in it which performs the same function as the DBLSPACE.SYS file does; it relocates the Stacker DBLSPACE.BIN program from conventional memory to upper memory.

There must be an upper memory area large enough for the program to load into. Otherwise, the program is loaded into conventional memory.

- There are additional memory-saving techniques that Stacker can perform. The Stacker manual shows information about storing the Stacker cache memory area in expanded memory to conserve conventional or upper memory. You can also save memory by *not* using the Stacker Automount feature. Check the Stacker manual for more details.

Booting Up Without Stacker Versions 3.1 or 4.0

With DOS version 6.2 and above, you have the option to boot up without the Stacker program running. Some games that write data directly to video RAM can cause problems with Stacker. Stacker

keeps a small amount of data in memory so that it can expand it later. When a software program writes information directly to video RAM, it makes this section of memory temporarily unavailable to Stacker. Screen graphic problems can result.

The non-Stacker bootup option can be useful in the following situations:

- You are having problems with the Stacker program files causing the computer to hang at bootup time.
- You need more memory available because the Stacker DBLSPACE.BIN file is not loading into upper memory.
- You wish to run programs stored on your hard drive's uncompressed host drive (there are some programs that won't run properly under Doublespace, or they run too slowly).

To boot up without Stacker loading, press the Ctrl key and either F8 or F5 at bootup time. When you bypass Stacker, you won't have access to the CONFIG.SYS and AUTOEXEC.BAT files, because they are on the compressed drive. You can copy your system files from the compressed drive to the uncompressed drive (H) before you bypass Stacker, or you can copy new versions of the files there. You'll also need any programs or device driver files on the uncompressed drive.

Pressing Ctrl+F8 allows you to process the CONFIG.SYS and AUTOEXEC.BAT files one line at a time. Pressing Ctrl+F5 bypasses the system files completely.

The computer will not have access to any of the compressed files on the Stacker drive during this session. If you have to correct a problem with the Stacker files, you can copy them from your DOS setup or backup diskettes to the root directory of your hard drive.

Additional Resources

For more extensive information on the DOS 6 Doublespace program, I suggest reading *The Microsoft Press Guide To DOUBLESPACE* by Doug Lowe (Microsoft Press).

You can contact Stac Electronics' Stacker technical support at the following numbers:

phone: (619) 431-6712 fax: (619) 431-1073

BBS: (619) 431-5956 and (619) 431-7405

Part 8

Windows Troubleshooting

The number of Windows games and multimedia applications is increasing rapidly. Software manufacturers believe it is easier for users to install and run games from Windows than from the MS-DOS prompt. Also, the games can utilize Windows files and drivers for sound and video playback; the game manufacturer doesn't need to supply those utilities.

But just as DOS game performance is contingent on the CONFIG.SYS and AUTOEXEC.BAT file settings, a Windows game depends on the settings and resource capabilities of the version of Windows it's installed in.

Understanding the Windows Environment

This section will show you how to get your Windows games installed properly and keep them running without altering the Windows environment. You'll also learn how to keep track of Windows files; install Windows video and sound drivers; optimize Windows resources, and *uninstall* a game properly.

Windows Game Quick-Start List

If you have a problem starting a Windows game, take the precautions explained in the "Before You Begin" section of this

book and then check the quick-start list below for an answer to your problem. After going through the quick-start list, check the information given to learn about the Windows environment and how to keep it and your games running properly.

- Before installing any new game, software program or add-on utility, back up your DOS and Windows files; don't make *any changes* to these files until you have done so. Make copies of the CONFIG.SYS and AUTOEXEC.BAT files from your C:\ directory. From your Windows directory, copy all of the files with INI, GRP, and INF extensions. You should copy all of these files to *two* floppy diskettes for safekeeping.

- When installing Windows games, always refer to the manufacturer's instructions. Without a manual, there are two alternate methods for installing Windows programs. First, from the Program Manager screen, click on the File menu, and select Run. Then type in the commands specified in the game instructions to install the application. Usually the command will be **A:SETUP** or **A:INSTALL**.

  If the game doesn't install, or if you get error messages on the screen, you can try the second installation method. From the Windows Main group, double-click on the File Manager icon. With the diskette in drive A, click on the A: disk drive symbol at the top-left corner of the screen. Then look at the file listing in the right column for the SETUP.EXE (or INSTALL.EXE) file and double-click on it. The installation program will begin.

- If you get a message after you load a game that says "DMABufferSize is too small. Set to 32," you can edit your Windows SYSTEM.INI file to correct this. To edit the file in Windows, at the Program Manager screen click on File and choose Run. On the Run line, type **SYSTEM.INI**. A Notepad screen will appear with the SYSTEM.INI file on it. Locate the [386Enh] section of the file and find the line that says DMABufferSize=*xx*. You must increase the number given to the number that the game program recommends. If you do not see a line like this, create one (be sure to make it appear like it does here—with the same capitalization), for example: DMABufferSize=34. Save the file, exit, and restart Windows. The game should now load normally.

- If you've changed your video display driver in Windows and it has blacked out the Windows screen, you can get to the Windows setup program from the DOS prompt. At the C> prompt, type **CD\WINDOWS** and press Enter. Then type **SETUP**. You'll see a display line with the name of the new display driver. Highlight it and then choose the display driver you had previously. Hit Enter three times and you'll be left at the DOS prompt. Type **WIN**, press Enter, and Windows will start.
- Some Windows games use the QuickTime compression method for producing high-resolution graphics. You can check this possibility by viewing the QTW.INI file. In Program Manager, click on the File menu and choose Run. Type **QTW.INI** on the Command Line and hit Enter. You'll see a Notepad screen displaying the file text. Make sure that the [VIDEO] section of the file contains a line that states OPTIMIZE=DRIVERS or OPTIMIZE=BMP. The line may instead read OPTIMIZE=HARDWARE. If it does, change it. If there is no line like this, write one, save the file, and restart Windows. The video graphics should then appear fine.

Windows Versions

If you are using Windows 3.0, *upgrade to version 3.1*—ASAP! Windows 3.1 is a much more stable product that runs faster, has multimedia facilities built in, and crashes less often than 3.0. Additionally, 3.1 allows you to back out of an application if something goes wrong. You can usually exit the offending game and continue Windows *without* corrupting or damaging other Windows files.

Windows has two modes it can run in: Standard and Enhanced. Standard mode can run on a 286 PC with a minimum of 1 megabyte (MB) of RAM. It can also run some applications *faster* than Enhanced mode, because it doesn't use a swap file for virtual memory. You can't run too many applications concurrently, and any DOS applications will stop if you switch back and forth between them and Windows programs. You can start Windows in Standard mode by typing **WIN/S** at the DOS prompt.

To run Windows in Enhanced mode, you need to have a 386 (or higher) processor and at least 2 MBof RAM. Enhanced mode can use virtual memory (your Windows swap file) to run more applications and can have more DOS applications running simultaneously (they keep running in the background even when you switch to another Windows application). To start Windows in Enhanced mode, type **WIN/3** at the DOS prompt. (Windows will automatically start in Enhanced mode when you type **WIN** at the DOS prompt, as long as you have the right processor and enough memory.)

You should test your game performance in both Windows modes. Test for loading time, game-running speed, and whether your games run out of memory or crash. (Note that some of the newer games on the market *must* run in Enhanced mode.) After checking the results of your tests, you may decide that for games you'll prefer to run in Standard mode and for regular Windows applications you'll use Enhanced mode.

Windows 3.11 is essentially the same as Windows 3.1, with the addition of updated device drivers. There are no new programs or functions included with this version. Windows for Workgroups 3.11 provides all the needed software to access the files and printers on other computers and to share files and printers from your own machine. In addition, you can communicate with others using MS-Mail, At Work PC-FAX, and Schedule+, which are all included in this version. New 32-bit code can increase the speed of network and hard-disk access over Windows 3.1.

Optimizing Windows for Games

You probably already know that DOS games shouldn't be run in Windows. They either won't load or you'll receive "sound contention" errors on the screen. Even if the games seem to run properly, you wouldn't want your PC to lock up while Windows is still running—it can corrupt or destroy critical Windows files. But the next piece of advice is even more important for Windows-based games: ***DON'T RUN WINDOWS GAMES IN WINDOWS!***

That may sound like a strange way to start off the Windows games section, but it is the *only* way to prevent the inevitable problems that will occur with nearly a third of all Windows games and other multimedia applications.

Virtually all Windows games will rewrite your critical Windows system files (SYSTEM.INI, WIN.INI, PROGMAN.INI, and CONTROL.INI) and place other files in your Windows directory (and in other areas of your hard drive). *Anything* you install in Windows can upset the entire working environment. Just one errant screen saver, a seemingly innocent wallpaper add-on or a new utility application can bring your Windows world crashing down. Unless you thoroughly understand *every* function, option, and meaning of all 400+ lines in your system files (plus any new ones that the games will install), I wouldn't suggest loading games in your present version of Windows.

The only way to ensure that a game will not damage your version of Windows is to install *another version* of Windows in a *different* directory on your hard disk and install your games there. If you have 5 MB of hard-drive space to spare, this method will keep your important business applications separated from your games and other multimedia applications (such as the educational or entertainment programs you load on CD-ROMs). This way if a game locks up or alters your Windows configuration, you'll still be able to use your regular version of Windows for important work; you can troubleshoot the secondary version later.

To get started creating a second version on Windows, first check the amount of free disk space you have. At the C> prompt, type **CD** and press Enter. Then type **DIR**. You'll see a message listing the number of bytes free. You'll need at least 4 to 8 MB of free disk space for another copy of Windows to run in (including its swap file and room for your games).

To install a new copy of Windows, put the first Windows installation disk in drive A (or drive B, depending on your machine setup). Type **A:** and hit Enter. Next, enter **SETUP**. Windows will begin the installation process. When it asks, **Is the directory below, C:\WINDOWS OK?**, give the directory another name, such as C:\WINGAMES. Windows will then install a new copy of Windows into the C:\WINGAMES directory. If you have Windows For Workgroups, you don't need to install any of the network group files or applications.

When the installation is complete, you can either use your regular Windows program for business applications or exit and change to the other Windows directory by typing **CD\WINGAMES**. Then type **WIN** to start the new, game-running version.

If you have any software drivers to load for the new Windows version—for example, your sound card drivers for Windows—load them with the installation disk(s).

To save hard-drive space on the new, game-running version of Windows, you can eliminate unnecessary files, accessories, and applications. From the Main group, click on Win Setup and then click on the Options menu. Select Add/Remove Windows Components. The dialog box that appears will allow you to select Windows files for wallpaper, screen savers, games, accessories, and README files. You can delete these files from your hard disk to save space.

Next, in the Control Panel group, click on the Fonts icon and remove all but a couple of fonts that you prefer.

You can use the Windows File Manager to delete more programs and files within this game version of Windows—but *proceed cautiously*. Make sure that you have the proper directory listed in the left column—C:\WINGAMES—*before* you start deleting files!

The listing below displays some of the file types included with Windows that will probably be of little use in your secondary games version. Files related to the programs are also listed (e.g., files for initiating programs and providing Help screen information). To quickly see the files in your Windows directory in order of type, from the Main group, click on File Manager. Click on the View menu and choose the Sort By Type option.

Keep in mind that this is only a partial listing and you may want to keep some of the program files listed for convenience.

Windows Program Files that Can Be Deleted In Your Secondary Windows Version

File Extension	Type of File
BMP	Bitmapped graphics file
DOC	Documentation file
.WRI	Write file
TXT	Text file
WAV	Sound file
HLP	Help file

Other Files You Can Delete from The Windows Directory

MOUSE.COM	MOUSE.INI	MOUSE.SYS
HIMEM.SYS	EMM386.EXE	MSD.INI
MSD.EXE	DRWATSON.EXE	EXPAND.EXE
SMARTDRV.EXE	WINTUTOR.EXE	SMARTMON.EXE
PRINTMAN.EXE	PIFEDIT.EXE	CLIPBRD.EXE
SYSEDIT.EXE	WRITE.EXE	RAMDRIVE.SYS
MORICONS.DLL		

Additionally, some of the other DLL files can be deleted, but proceed with caution. If you accidentally remove a DLL file that you need later, copy it back from your other Windows directory.

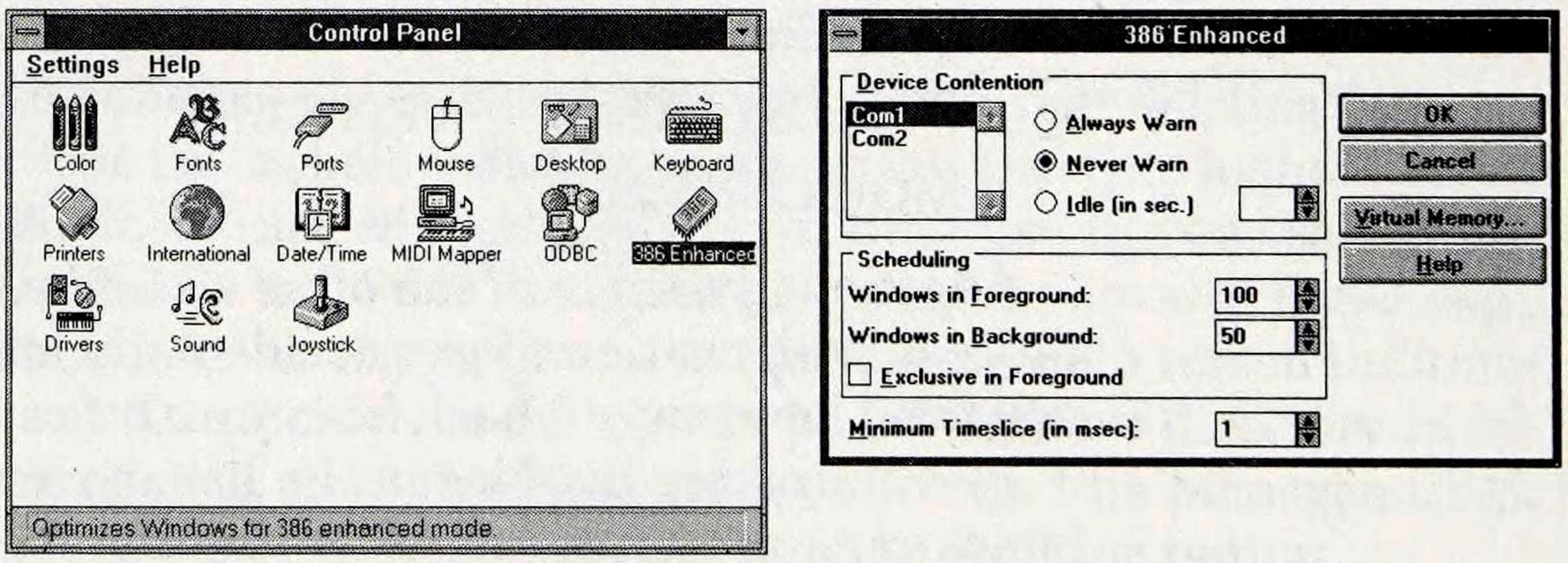
By eliminating the files in the list above, you'll have a bare-bones version of Windows that should take up less than 2 MB of hard drive space! Combined with the swap file that it will create, you'll still have plenty of room to have one version of Windows for work and one for play installed simultaneously. Since you need less than 10 MB for another copy of Windows to run (depending on the swap file size you select), *it just isn't worth the risk* of ruining your precious original copy by using it to run games.

More Windows Game-Running Tips

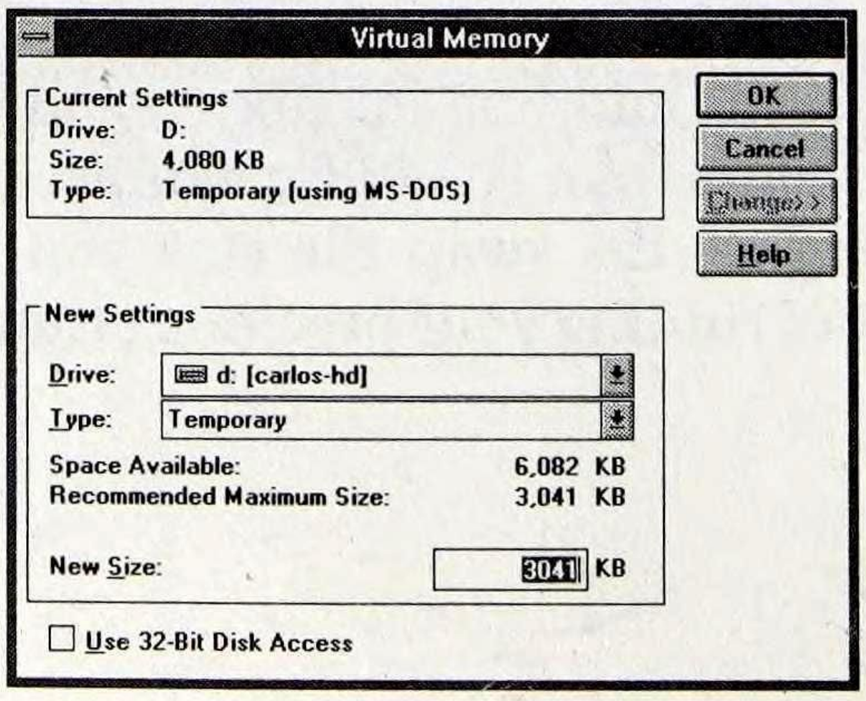
- If you do not have a permanent swap file for Windows, create one. A *temporary* swap file must be created and deleted *on every Windows session*. This delays the start and exit from your Windows session, because Windows must create and check a log of where the swap file is located on the hard disk; it will be spread out in various sections. A *permanent* swap file is only created once and is in one contiguous area on the hard drive.

  Before you create a permanent swap file, I recommend that you defrag your hard drive and back up your software first. To create a permanent swap file (or to check the swap file type and size), from the Control Panel's 386 Enhanced option, click on the Virtual Memory button. You'll see a dialog box showing the size and type of swap file Windows is using. If it is set as **Temporary**, click on the Change button and choose **Permanent**. A suggested swap file size will appear. You can choose the size listed or experiment with a smaller size to save hard-disk space. You'll have to restart Windows before the changes will take effect.

Use the Control Panel to check the 386 Enhanced settings.



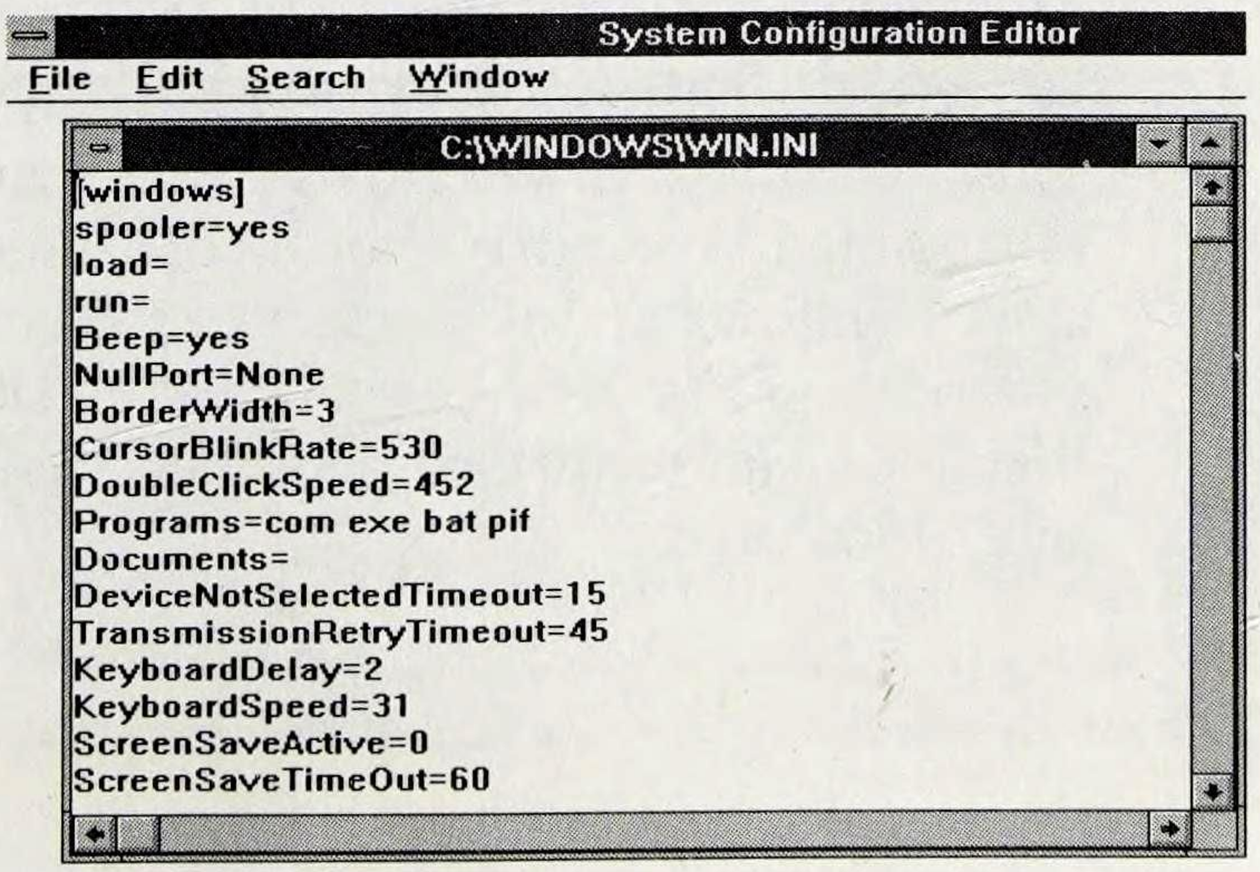
The Virtual Memory dialog box.



A permanent swap file allows Windows to use your free hard-drive space as a storage area for swapping out files from memory. It also allows you to use the 32-bit disk access option (also found in the Control Panel's 386 Enhanced window) to speed up hard drive access to files.

- To gain more resources than the Windows Program Manager shell program can provide, you can purchase and install a different shell program to launch your Windows applications. Many Windows shell programs include a gauge so you can visually monitor your system-resource levels.
- To *speed up hard disk access* within Windows, activate the FastDisk option from the Control Panel's 386 Enhanced window. If the option box is available to be checked off, click on the box. You'll be prompted to restart Windows for this option to take effect.
- Keep track of the files in your Windows directory and make backup copies of all of the files that end with INI, INF or GRP. Most Windows games will make changes to the SYSTEM.INI and WIN.INI files located in your Windows directory. The only way to keep track of your critical Windows files and settings is to have a point of reference. Check your MS-DOS book on how to use the File Compare function to compare a copy of your Windows system files before and after a game installation. (You can make a copy of your Windows SYSTEM.INI and WIN.INI files and copy them to another directory before you install an application. After the installation, use the File Compare command to display which lines in the files are different; put this information on a game log sheet (provided in the reference section of this book).

Checking Windows' WIN.INI and SYSTEM.INI.



Altering the Windows Shell Program

Some Windows games *must* be loaded and run only within the Windows Program Manager shell. (A *shell* is a program that can launch applications.) Windows includes two programs that can be used as a shell program: Program Manager and the File Manager. If you have another program-launching shell program that appears when Windows starts, you may need to have Windows start up with Program Manager to see if it solves the loading problem (Tabworks and Dashboard are other shell programs for Windows).

To change the Windows shell program, you must edit the SYSTEM.INI file, which is in your Windows directory. From the DOS prompt, type **EDIT C:\WINDOWS\SYSTEM.INI** and press Enter. The SYSTEM.INI file will appear in the EDIT screen. The first line in the file is the boot section. The line below it is the shell line, which controls which program will be used as the Windows shell. Write the contents of this line down for reference in case your want to return to the original shell program. To make Windows use Program Manager as the shell, edit the line to read shell=progman.exe. Save the file, exit, and restart Windows. Now test the game to see if will load properly.

Troubleshooting Windows Game Problems

- If you start Windows by typing **WIN /B**, a file called BOOTLOG.TXT will be created in the Windows directory. The file will list the various device drivers that are needed to load Windows. You can view the file with the DOS EDIT program or with the Windows Notepad. If you look at the last few lines, you'll find which file failed to load.

- Video problems in Windows can be caused by an improperly loaded video driver or a corrupted driver file. If you start Windows and it blacks out the screen, displays poor video images or bounces back to the DOS prompt without displaying an error message, then suspect a bad or incorrect video driver.

You can easily test this theory by changing to the standard VGA driver that is included with all versions of Windows. From the DOS prompt, change to the Windows directory, enter **CD\WINDOWS** at the DOS prompt, and then type **SETUP**. Look at the driver shown on the display line and highlight it by using the arrow keys. Hit Enter and you'll get a list of the video drivers. Scroll down the list until you get to the VGA driver, and hit Enter again. Hit Enter twice more and you should be back at the DOS prompt. Type **WIN** to enter Windows; you should see a plain Windows display.

If a game program or another software application has improperly rewritten your Windows WIN.INI or SYSTEM.INI files and you don't have backup copies, you can copy the original versions from your Windows installation diskettes. They are compressed on the disk under the names WIN.SR_ and SYSTEM.SR_. (The underscore character "_" in these filenames indicates that the file is compressed.) First, copy the present files from your Windows directory to another directory. When you locate the disk with the files on it, you can expand and rename them with the following command:

```
EXPAND A:WIN.SR_ C:\WINDOWS\WIN.INI
```

Substitute the SYSTEM.INI filename for the WIN.INI filename to expand and copy it to the Windows directory. Windows should load properly. It will not have any special icons or settings as it did before, but it will run. Compare the old and new versions of the files to troubleshoot the cause of the problem.

Windows Startup Troubleshooting

If Windows fails to start or locks up during startup, you can launch it with the command **WIN/B** and it will create a file called BOOTLOG.TXT. This file keeps track of everything that Windows does to run and load program files. When you start up Windows with the /B switch, it will write information to the BOOTLOG.TXT file about every single file needed to start a Windows component. After the computer fails to start Windows, you can use the DOS Edit program to view the file.

To view the BOOTLOG.TXT file, first change to the Windows directory. Enter **CD\WINDOWS** and then type **EDIT BOOTLOG.TXT**. The DOS Editor will display the file contents. A typical listing will look like this:

```
LoadStart=MOUSE.DRV
LoadSuccess=MOUSE.DRV
```

Look at the last few lines of the file. It will show the name of a file that failed to load, for example: LoadFail=WIN3DRV. Write down the name of the file and locate it on one of your Windows disks (or extra driver disks if it is a video driver, sound driver, etc.). Exit the DOS Edit program and perform a disk check to search for any corrupted files.

At the DOS prompt, type **CHKDSK/F** and press Enter. If DOS asks, **Do you still want to run checkdisk?**, type Y for Yes. If any cross-linked chains or lost allocation units are found, type N to answer No to the question **Convert lost chains/allocation units to files?** The listing shown will display memory usage and will indicate any lost allocation units or cross-linked chains.

Windows Automatic Startup Troubleshooting

Check the items in the Windows Startup group before loading a game. If you have a recurring problem with a Windows game, start Windows by holding down the Shift key after you enter **WIN** to start Windows. This will prevent it from loading any applications from the Startup group. If the game lock-up problem ceases, you can find the conflict by starting each program from the Startup group and then loading the game. After running the first application successfully, stop the Startup programs and load the next application and game. By trial and error, you'll find which application is causing a conflict in Windows.

Other Windows applications may be loading in Windows at startup time without your knowledge. The Windows WIN.INI file in your Windows directory sets parameters that Windows follows during startup time. There are two lines in the file that can automatically load programs. They are the LOAD= and RUN= lines.

To see what your Windows WIN.INI file looks like, go to the Program Manager screen, pull down the File menu (click on File or hold down the Alt+F keys), and select the **Run** option.

Type **WIN.INI** on the Command Line and hit Enter. A Notepad screen of the WIN.INI file will appear. Check the lines in the WIN.INI file that begin with LOAD= and RUN=. If there is nothing else on the lines, then they will not load any Windows applications.

If there are other items on either of the lines (e.g., LOAD=C:\WINDOWS\POINTER.EXE), you can make Windows bypass loading the application(s) by placing a semicolon and a space at the beginning of the line (e.g., ;LOAD=C:\WINDOWS\POINTER.EXE).To have the changes to the WIN.INI file take effect, you must close the Notepad program; hold down Alt+F4, and choose Exit. Save the changes to the file and exit Windows. When you restart Windows, it will not load the application(s), so you can see the difference that loading those files makes to the program.

Windows Resource Problems

The Windows environment became popular because of its graphical user interface and its ability to run multiple applications simultaneously. Using a 386 or higher processor allows Windows to simulate many different PCs running applications (DOS and Windows programs) as if they had the PC's resources all to themselves. But Windows does have resource limits. Being aware of its vulnerable areas will allow you to run games smoothly and prevent crashes.

The Windows environment works with "resource heaps" of memory that provide workspaces for Windows applications. These memory area heaps manage the utility functions of the Windows environment, including producing menus and dialog boxes on the screen; creating and maintaining group windows, icons, buttons and toolbars; overseeing printing operations; and more.

If you receive an "out of memory" message in Windows, it doesn't mean you are really out of system memory. This section will explain what Windows resources are and how to keep the maximum amount available for running games.

You can monitor the Windows resource level from the Program Manager screen by clicking on the Help menu and choosing About Program Manager. You'll get a message at the bottom of the dialog box that shows available memory and system resource level. The

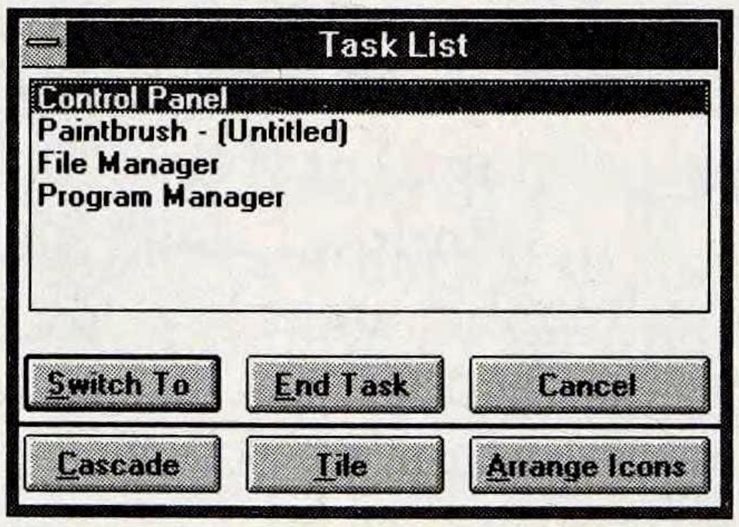
amount of memory free represents the Windows swap file settings chosen in the Control Panel's 386 Enhanced window. The system resources percentage free statement displays the lowest percentage of free space in one of four heaps. (A *heap* is a 64-kilobyte segment of memory that handles part of the Windows graphical environment.)

There are ways to keep the Windows resource level high, which will prevent game-loading and lock-up problems. Most of the methods deal with keeping the amount of graphical images in Windows to a *minimum*. Producing high-resolution images takes a lot of computing power—especially when Windows has to redraw screens.

Before launching a Windows game, check the system resource percentage free. If it is not above 80 percent, then you can take the following steps:

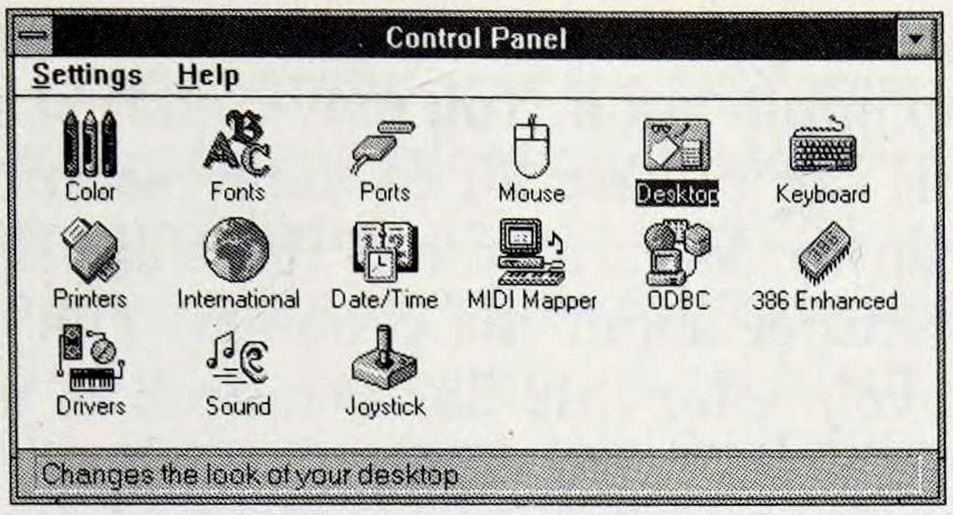
- Check the Windows Task List to see how many applications are running. Double-click on the Windows Desktop or press Ctrl+Esc. Quit any active programs on the list (except the Program Manager).

The Windows Task List shows you how many applications are running.

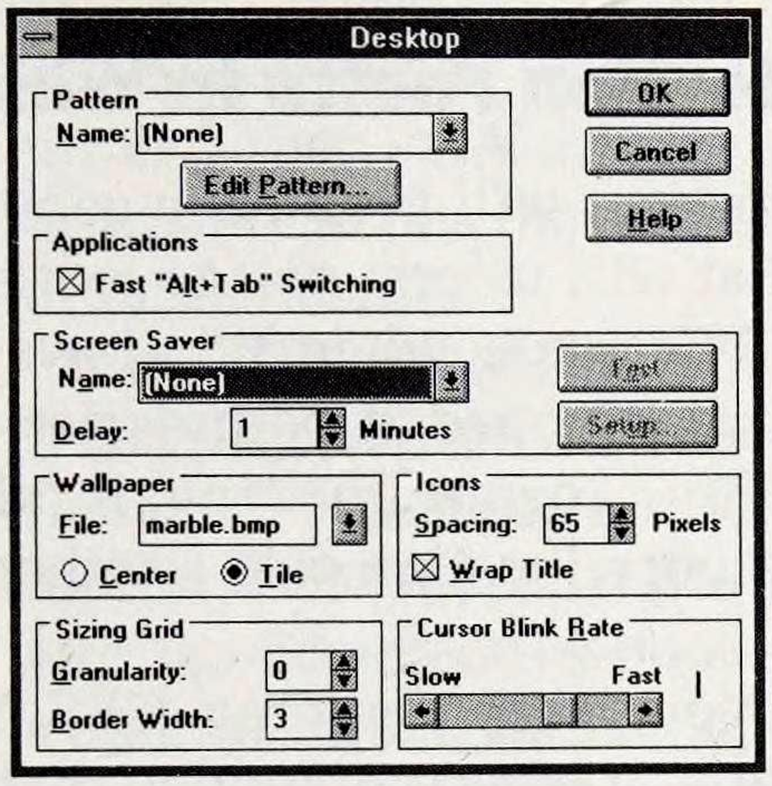


- Keep the number of open Window groups and dialog boxes to a minimum.
- Keep the number of fonts loaded at startup time to a minimum. Check the Fonts window in the Control Panel and remove any fonts you do not use. This will make Windows load faster, too.
- Deactivate any wallpaper or screen savers you have loaded. To do this, double-click on the Desktop icon in the Control Panel.

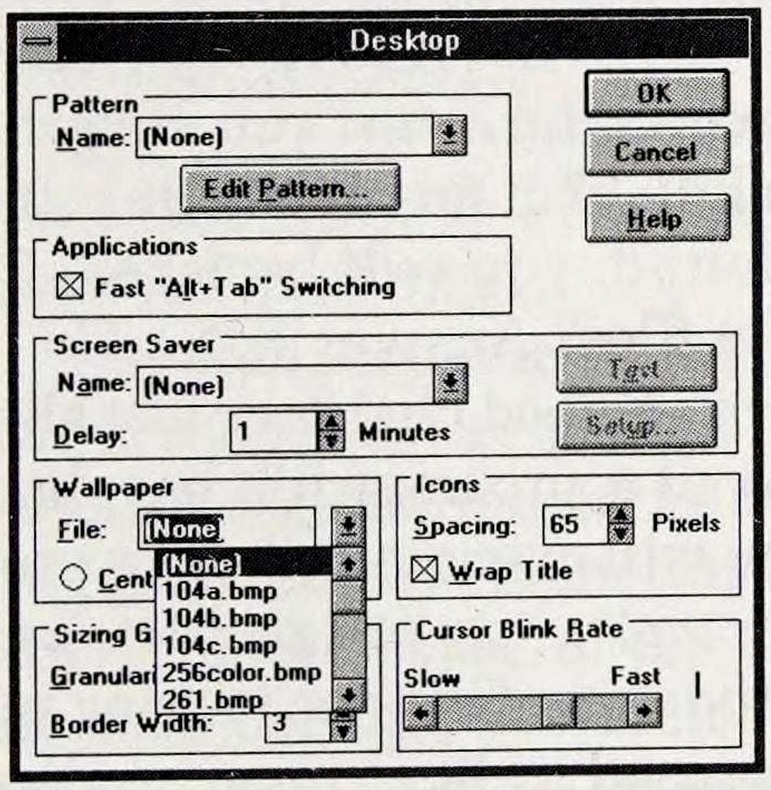
To deactivate wallpaper and screen savers, click on the Desktop option in the Control Panel.



To deactivate a screen saver, choose None from the Screen Saver name list.



To remove wallpaper, choose None from the Wallpaper name list.



- If open programs have any toolbars or ribbon selector options, remove them from the screen. Keep any open application screens as plain as possible graphically.
- Check the video resolution that Windows is running in. Keep this to a minimum at which Windows will run all of your applications—usually 640 × 480 with 256 colors.
- Drag all of the most frequently used icons into one or two Windows groups. Close all other Window groups or keep them minimized.

Check your system resource level before, during, and after you load an application. You may find that some of your applications will not release all of their resources after they have been shut down. Make a note of these applications and contact the manufacturer about the problem. The only way to regain resource levels after this has occurred is to exit and re-enter Windows.

General Protection Faults in Windows

Occasionally Windows will produce a general protection fault (GPF) message that will inform you to exit the program to prevent data loss. GPFs occur when Windows detects a software application has overstepped it boundaries in memory. If you kept the application program running, it might rewrite important data in a memory location that another program is using, corrupting it.

In most cases, you cannot ignore a GPF. You must close the running application. It is recommended that you also exit Windows and reboot your computer. Perform a disk check to search for any corrupted files. After the reboot, exit Windows and type **CHKDSK/F**. Answer [Y] for Yes if you are prompted, **Do you still want to run checkdisk?** If any cross-linked chains or lost allocation units are found, you will be asked, **Convert lost chains/allocation units to files?** Answer [N] for No.

If there were cross-linked chains or lost allocation units found, it means that part of a program file has disconnected from the rest of the file. You will eventually have a problem with a certain program (or Windows) when you perform a certain function. If a program keeps producing GPFs or locking up, reinstall it.

GPFs are also caused by bugs in an application program. The best way to test the validity of your game is to close all running applications and restart Windows. Run the game with no other applications running. If it still causes a GPF, try to install the game on another PC running Windows and test it. Or, if you have enough hard drive space, install another copy of Windows into a new directory, install the game there, and run it. If you still get GPFs in another version of Windows, then it is very likely a buggy game or device driver. Substitute another video driver in Windows and restart the game. (Use the VGA or Super VGA Windows driver.)

Look carefully at the GPF message. It will give you a clue to where the problem originates. For example, if a GPF states that the problem is in Module 256 *xxx*, it usually indicates that a high-resolution video driver (256-color mode) has caused a conflict with a program. A problem with the GDI.EXE file causes this error message, too. Switch to another driver for your video card (or use the VGA driver included with Windows to test the problem). If you need a high-resolution driver, contact the video card maker for an updated driver version or use the high-resolution Super VGA drivers available from the Microsoft Download Service. See the section of this book on getting help online for more details.

If the GPF states that the problem is in the KRNL.386 file (or if starting Windows produces an error message with this filename), a memory conflict is probably the cause. Try bypassing the EMM386.EXE file loading from the CONFIG.SYS file with the F8 selective-bootup procedure. If doing this stops the problem, check older copies of CONFIG.SYS files on your backup disks or in other subdirectories on the hard drive. There may be an Exclude statement missing from the EMM386.EXE file (e.g., X=C901).

If this doesn't solve the problem, copy a new version of the EMM386.EXE file from your DOS diskette to the DOS directory on your hard disk.

General protection faults involving the USER.EXE file can have numerous origins. This file can be changed by a user's altering registration information and by software programs loading in Windows. Sometimes a bad sound card driver or mouse driver is the cause of the GPF. Or it could be that the file has become corrupt, in which case it needs to be rewritten with the original version from the Windows installation disk. Copy a new version of the file to the WINDOWS\SYSTEM subdirectory and restart Windows. This should solve the GPF problem.

Troubleshooting General Protection Faults in Windows

A good Windows application will not usually produce general protection faults. But as you use applications, some files can become corrupt during usage or they may have problems working with certain software drivers. Here are a few tips to prevent GPFs while running Windows:

- If you have been using Windows for a long period of time, check the system resource level. In Program Manager, click on the Help menu and choose About Program Manager. Look for the percentage free statement at the bottom of the dialog box. If the Windows system resource level goes below 60 percent free, GPFs can occur.
- Perform a CHKDSK command on your program files often—about once a week—to detect corrupt files early.
- Obtain and install the latest versions of all driver files used with your system, including video drivers, sound drivers, CD-ROM drivers, and other drivers listed in your CONFIG.SYS and AUTOEXEC.BAT files. Check the Microsoft BBS for any updated drivers.
- Try running Windows in Standard mode. At the DOS prompt, type **WIN/S**. See if this makes the GPFs disappear.
- Run Windows without using any upper memory. Type **WIN/D:X** at the DOS prompt. If the GPFs do not appear, check the CONFIG.SYS file to ensure that the EMM386.EXE line has the correct exclusions at the end of the line. Sometimes these change when you install a new version of MS-DOS.
- Boot up with a minimum configuration. By holding down the F8 key before you see the **Starting MS-DOS....** message, you can process just the files needed to run Windows. Basically, the only file necessary to run Windows is HIMEM.SYS. From the AUTOEXEC.BAT file, just process the PATH line. Start Windows and try to recreate the conditions that produced the GPF. If none are detected, reboot the PC, process more lines, and note the difference. Notice which file processed during that session caused a GPF.
- To isolate Windows game conflicts, make sure that no other programs are loading or running when Windows starts. Check the Startup group for any icons. If there are icons there, drag them to another window group temporarily and restart Windows. Check the WIN.INI file for any programs or utilities loading; the lines LOAD= and RUN= should be blank. If they are not, place a semicolon and a space in front of the lines so that Windows will ignore them (e.g. ; LOAD=). Also, turn off screen savers, unload wallpaper designs, and deactivate any timer, alarm or reminder programs that may be running.

- Make sure the SYSTEM.INI file loads the standard Windows drivers for MOUSE.DRV, COMM.DRV, KEYBOARD.DRV, and SYSTEM.DRV. These drivers should equal their own names, for example: MOUSE.DRV=MOUSE.DRV. If these drivers are set equal to other driver names, write down the lines, edit them as noted above, save the file and restart Windows. If you stop getting GPFs, isolate which driver file is causing the problem and request an updated version from the program manufacturer. If the General Protection Fault keeps appearing, edit the files back to their original specifications.
- If Windows produces a general protection fault when you load the EMM386.EXE file, you can prevent Windows from using upper memory. At the DOS prompt, type **WIN/D:X**. See if Windows produces any more GPFs. If they stop appearing, then Windows is trying to use an excluded area of upper memory that it shouldn't. (If you have Windows 3.0, once again, *upgrade to version 3.1!*)

Advanced General Protection Fault Troubleshooting

The tips listed in this chapter should be enough to track down the source of general protection faults on virtually any PC running Windows. Remember, the information given in this book is based on the assumption that you have a *good* copy of MS-DOS and Windows running on your machine. There are more methods available to locate GPFs, but they are for advanced users who are very familiar with the inner workings of the Windows environment. A little knowledge about critical Windows system files can cause a multitude of problems.

If you are interested in learning more about Windows, you can refer to other resources, described briefly here.

Microsoft has a file to help you further with troubleshooting general protection faults. It's called WW0524.ZIP, "Troubleshooting General Protection Faults."

You can call Microsoft at (800) 426-9400 for information about receiving the file. If you have CompuServe, log on and type **GO MSL** to go to the Microsoft forum. You can download the file from there.

If you want to go further to troubleshoot Windows general protection faults and other problems, I suggest that you obtain the Microsoft "Windows Resource Kit." It includes a 538-page book and diskette and is a bargain for anyone interested in learning how Windows works and how to troubleshoot it. The book includes extensive information not found anywhere else, including a detailed listing of all the parameters in the SYSTEM.INI and WIN.INI files and a detailed troubleshooting section with logic charts and diagrams. The diskette includes a system resource monitor program (worth the price of the kit itself!), a graphics viewer utility, a network assistant program, a SmartDrive monitor, and more. Windows Write data files on the diskette describe the procedures to follow when editing the SYSTEM.INI and WIN.INI files.

If you are thinking about altering any of your Windows system files, I suggest getting this kit before you proceed. The "Windows Resource Kit" is available from Microsoft; call (800) 642-7676 to order. As of this writing, the kit sells for $19.95. Other kits are available for Windows for Workgroups and Windows NT.

Miscellaneous Windows Problems and Solutions

☞ Another loading problem can occur when you click on a Windows game icon and you get this message:

```
Cannot find file or one of its components. Check
to ensure that the path and file name are correct
and that all required libraries are available.
```

This means that Windows didn't find the game startup file where it should be located on the hard disk or some of its other program files that make up the program. Windows stores the startup filename and directory location of your game program in a "program item properties" information file.

You can see this information by holding down the Alt key while you click on the game application's icon. If everything looks okay, it usually indicates that there are corrupt files in your games directory or files missing altogether. It would be wise to reinstall the program.

If necessary, reinstall the file into a new directory and try running it there. If this works, delete the files from the original game directory to save hard disk space.

- If a CD-ROM drive cannot be accessed from Windows and doing a DIR command at the DOS prompt gives the error message **EMM no longer valid, CDR 102**, check the MSCDEX.EXE file line in the AUTOEXEC.BAT file. If there is a /E at the end of the line, remove the /E, save the file, and reboot the computer. Loading the MSCDEX into conventional memory will also solve this problem.
- If you have Windows For Workgroups 3.11 and are not connected to a workgroup, you can start Windows with the WIN/N command for faster loading and exiting. The /N designation will prevent Windows from searching for a network connection during startup and exit.
- If you turn on the 32-bit disk access option in the Control Panel's 386 Enhanced window and Windows will not load, you can edit SYSTEM.INI to resolve the problem.

  Look for a line in the file under the [386Enh] section that states:

  ```
  32BitDiskAccess=on
  ```

  Simply change the *on* designation to *off* (32BitDiskAccess=off), save the file, and restart Windows.
- Reduce the number of fonts installed to a minimum. When too many fonts are installed in Windows, it can result in strange screen displays and other unusual behavior. Use the Control Panel's Font window to remove any fonts you don't need.
- Use the latest versions of your MS-DOS driver files, including HIMEM.SYS, EMM386.EXE, MSCDEX.EXE, and MOUSE.COM or MOUSE.SYS. Write down which versions you are using; at bootup, look carefully at the screen and you'll see which versions of HIMEM.SYS and MSCDEX.EXE are loading. Type the remaining filenames at the DOS prompt to see which versions are presently installed.
- Call the manufacturer of your Windows games and request the *latest* version of the game. Ask about any known conflicts and if there are patch disks available to solve these conflicts.

- If you have recently installed a sound card and your PC already comes with a joystick port, make sure you keep the port on the card deactivated.
- If a game locks up or for some reason won't load, turn off EMS (expanded memory support). Step through the CONFIG.SYS file and bypass EMM386.EXE or edit it to say NOEMS.
- If you get a message that says a game needs to have DPMI support turned off, turn off EMS. Step through the CONFIG.SYS file and bypass EMM386.EXE or edit it to say NOEMS.
- If a game gives you an "out of memory" error in Windows, try exiting and starting the SHARE.EXE program; type **C:\DOS\SHARE.EXE** at the DOS prompt. Then re-enter Windows.
- If you have Windows For Workgroups 3.11 and are experiencing lockup problems, disable the 32-bit File Access option (not to be confused with 32-bit *Disk* Access). You can access this setting by double-clicking on the Control Panels's 386 Enhanced icon. Click on the Virtual Memory button and choose the Change option. By default, this option is not turned on. But if you have turned it on, turn it off if you experience inexplicable behavior from Windows games. Windows will have to be restarted for the change to take effect.

Important Windows Files Available From Microsoft

The Microsoft Download Library is a free BBS where you can obtain updated drivers and other programs to solve many software problems. You can access the MSDL with any modem. The phone number for the Microsoft Download Library BBS is (206) 936-6735. See the section on online support for more details on how to download files. Non-modem users can call Microsoft at (800) 426-9400 to have drivers and updated files mailed to them on diskette. Here are a few important files you should have:

- On the MSDL, you can obtain a master file list of all of the updated device drivers. The file is called WDL.TXT. You can view the file while you're online or download it and view it later to save long-distance phone charges.
- The MSDL also has updated Super VGA video drivers available. These drivers can be valuable when you are trying to troubleshoot multimedia games in Windows. The high-resolution video drivers can be used in place of the video card-specific device driver and you can compare their game-running performance. The drivers are saved in a compressed file called SVGA.EXE. Once it's loaded into a directory on your hard drive, just type **SVGA** and press Enter to expand the files. You'll have these five high-resolution drivers installed:

640 × 480	256 colors	
800 × 600	256 colors	Large fonts
800 × 600	256 colors	Small fonts
1024 × 768	256 colors	Large fonts
1024 × 768	256 colors	Small fonts

  You can use the Windows setup program to load the proper driver for Windows.
- Windows 3.1 users can obtain the VSHARE.386 file from the Microsoft Download Library. This file can be used instead of the DOS SHARE.EXE file to alleviate software conflicts. The filename to download is WW1000.EXE. This is a self-extracting file that should be loaded into a directory other than Windows.

Part 9

Pointing Device Issues

Games require user input for interactivity during game play. This interactivity is normally a one-way path—from pointing device (usually the keyboard, mouse, or joystick) to the game program. Unfortunately, game software can sometimes affect pointing device settings in the PC's CMOS setup and sound card configuration. Games can also accidentally delete or corrupt device driver files and rewrite important lines in the CONFIG.SYS and AUTOEXEC.BAT files.

This section will show you how to set up your PC to correctly use a joystick and mouse for game playing. You'll learn how to recover from a keyboard, mouse, or joystick failure due to a failed game installation, incorrect system file information, or corrupted device driver files. Joystick and mouse hardware-testing methods are shown, along with memory-optimizing tips for the mouse device driver.

Mouse Testing and Troubleshooting Tips

Returning to the PC-as-house analogy, the mouse and joystick on your PC can be thought of as a convenient hand-held remote control. They allow you to extend your reach and still have more

comfortable access to functions that would be impossible with just a keyboard. A hand-held remote control requires batteries and signal-receiving circuitry to be operating on the appliance (TV, VCR, or stereo component). Likewise, all mouse devices and some joystick models require a device driver to be installed before they will operate.

Games installations can affect mouse operation by deleting the CONFIG.SYS and/or AUTOEXEC.BAT file or corrupting the mouse driver file itself.

For Windows games, no extra mouse driver file need be loaded; Windows has its own driver that automatically loads when you launch it. When you use DOS programs, a mouse driver program must be loaded first—from the CONFIG.SYS file, at the DOS prompt or from the AUTOEXEC.BAT file. We'll see how each type should be installed.

If your mouse driver is loaded from the CONFIG.SYS file, you'll see a line there similar to this:

```
DEVICE=C:\WINDOWS\MOUSE.SYS
```

This line loads a mouse driver file from the Windows directory called MOUSE.SYS. Since this is a SYS device driver, it must be installed from the CONFIG.SYS file at startup.

The Windows 3.1 directory also includes a file called MOUSE.COM. It is a separate installable program that can be installed from the DOS prompt any time or from the AUTOEXEC.BAT file. A typical line loading it from the AUTOEXEC.BAT file appears as follows:

```
LH C:\WINDOWS\MOUSE.COM
```

This command will load the mouse driver from the Windows directory into upper memory. If the Windows directory is in your PATH statement in the AUTOEXEC.BAT file (e.g., PATH=C:\WINDOWS;C:\DOS;C:\), you could simply enter **LH MOUSE** at the DOS prompt to load the mouse driver. You'll see a screen display like this:

```
Microsoft (R) Mouse Driver Version 8.2a
Copyright (C) Microsoft Corp. 1983-1992.  All rights reserved.
Mouse driver installed.
```

Remember, even though the MOUSE.SYS and MOUSE.COM files are located in the Windows directory, they are *not* needed

or used in Windows. They take up memory when loaded, so if you are not running a DOS game or other program that uses a mouse, don't load it manually or from your AUTOEXEC.BAT file until you need it.

If you have Windows 3.1, you must use Microsoft Mouse driver version 8.20. Microsoft Mouse driver 8.20 is available on the following disks:

MS DOS 6.0 Upgrade disk #2 of 3 (compressed)
MS Windows 3.1 disk #2 of the 4-disk set (compressed)
MS Windows 3.1 disk #3 of the 6-disk set (compressed)

To uncompress (expand) the file from a disk and copy it to the Windows directory, place the appropriate diskette in drive A, and at the DOS prompt enter:

```
EXPAND A:\MOUSE.CO_ C:\WINDOWS\MOUSE.COM
```

You should load the most recent version of the mouse driver you use for DOS and Windows. Check the Microsoft Download Service or other online services for updated mouse device driver programs.

How to Adjust the Mouse Cursor Speed

The command to load the Microsoft Mouse driver (MOUSE.COM) can be edited to obtain adjustable speed for vertical and horizontal movement. In some games, slower or faster speed will be more comfortable during longer periods of use. These are some of the adjustment settings:

/Vx (adjusts the vertical speed)

/Hx (adjusts the horizontal speed)

/Sx (adjusts both vertical and horizontal speed)

where *x* is equal to a number ranging from 1 to 100 (1 being fastest and 100 being slowest).

Here are MOUSE.COM driver commands to obtain various cursor speed rates:

```
LH C:\WINDOWS\MOUSE.COM/V15
```

makes the mouse move slower in the vertical direction.

```
LH C:\WINDOWS\MOUSE.COM/H15
```

makes the mouse move slower in the horizontal direction.

```
LH C:\WINDOWS\MOUSE.COM/S40
```

makes the mouse move a little slower in both directions.

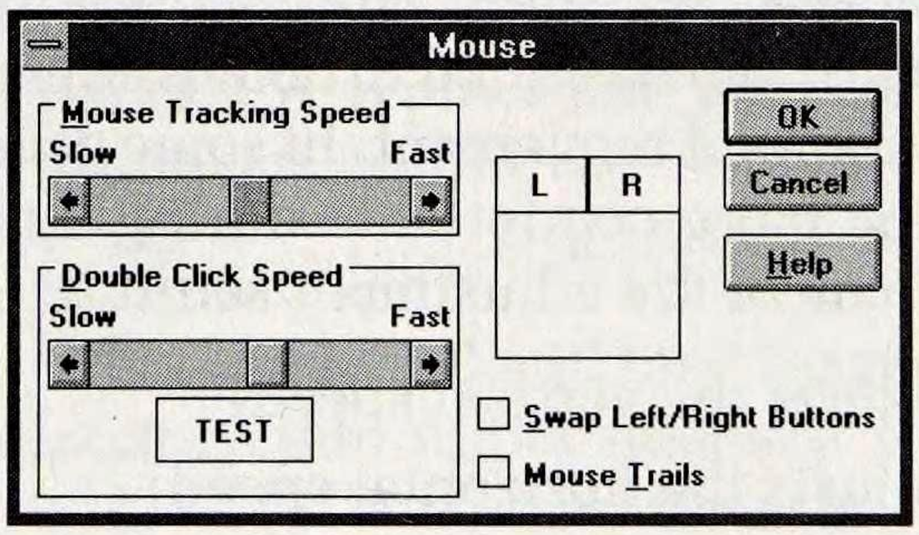
Mouse Setup and Adjustment in Windows

Windows includes a mouse setup application allowing you to control personal preferences for speed, size, appearance, and more.

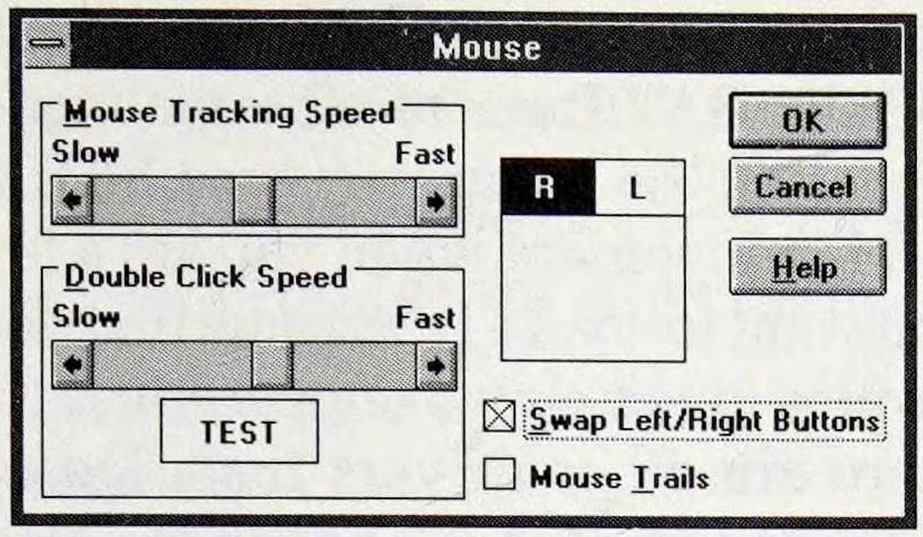
The following instructions concern the standard Microsoft Windows mouse setup application. Your machine may have a different mouse application program installed with more functions and options.

To access the mouse setup application, from the Windows Main group, choose Control Panel and double-click on the Mouse icon. A Microsoft Mouse window will appear. This Window allows you to select the mouse acceleration speed, double-click speed, and directional sensitivity. To set the mouse buttons, click on the Buttons option.

You can set various options in the Microsoft Mouse window.



A window appears to allow button preference selection. If you want the right mouse button to be the primary one (the left button is primary by default), click on the Set Buttons option. Another window appears, requesting you to press your preferred mouse button. Press the button you want to select as your primary button, and then click on OK.



The Button option allows you to change the default primary and secondary button settings.

The Microsoft Mouse program also allows you to select mouse pointer options as well. When you click on Pointer in the Microsoft Mouse window, a Pointer Options window appears. From this window, you can choose your mouse preferences for: size, color, and mouse trails. Click on OK when you have made your choices.

Different versions of the Microsoft Mouse Driver program include different setup applications. However, most will include similar procedures and functions.

Mouse Driver and Memory Issues

You may wonder why there are two mouse drivers included for DOS programs. Both will perform the same function and use about 17K of memory. Both can be loaded into upper memory. The crucial difference between the two files is *when* they load.

Which Mouse Driver Should You Use?

The MOUSE.SYS driver loads from the CONFIG.SYS file *before* other drivers and programs in the AUTOEXEC.BAT file.

MOUSE.COM can be loaded from the DOS command line or from AUTOEXEC.BAT. It can also be removed from memory without your rebooting the computer; type **MOUSE OFF** at the DOS prompt. This is convenient when you are a few kilobytes of RAM short and you want to load a DOS game that doesn't use the mouse.

The examples given above concern just the Microsoft mouse drivers. There are other drivers installed on PCs or available commercially. Become familiar with the device driver file that controls your mouse. Check BBSs for updates at least every six months for new versions or issues concerning it. Then it'll be easy to troubleshoot mouse problems when they occur.

Troubleshooting Mouse Problems

If your mouse driver program is correctly installed and you still have problems, the following things might be causing the problem:

- Loose or wrong connection
- The program does not support a mouse
- Mouse driver not loaded
- Disabled serial port (for a serial mouse)
- There is more than one driver in CONFIG.SYS or AUTOEXEC.BAT
- Corrupted mouse driver
- Other TSRs conflicting with the mouse driver
- Wrong mouse driver version
- Incompatible (PS/2-to-serial, and vice versa) adapters
- BAD PS/2 mouse port or serial port
- Bad mouse

If you still have problems, check to make sure that the mouse ball and rollers are clean. Ensure that the mouse is connected to the proper port. If available, try to attach another mouse on the port.

Testing the Mouse Port

To test for an inoperative mouse or serial port, you can use the MS-DOS DEBUG program. At the DOS prompt, type **DEBUG**

and press Enter, and then type **D40:00** and press Enter. You should get these results:

1st line: F8 03 or F8 02 for serial ports

2nd line: 61 C4 or 65 C4 for existence of a mouse port

When you are finished, type **Q** and press Enter to end the program.

To test for mouse movement on the DOS screen, first make sure that the mouse driver is installed, then at the DOS prompt enter **DEBUG**. Then type **A**. The DEBUG program will display a few numbers and letters after each line that you type, but just ignore them. Then type in the following commands, pressing Enter after each:

```
MOV AX,1
INT 33
INT 20
G
```

You should see a square block near the center of the screen. This is a DOS mouse cursor. Move the mouse around; the cursor should move accordingly. When finished, type **Q** and press Enter to end the program.

Joystick Testing and Troubleshooting Techniques

Joysticks are generally stable add-on devices. They are the one add-on card that does not require device driver software (although some specialty joysticks do). When game port cards started to appear for PC-compatibles, the hardware manufacturers chose a specific hardware port and I/O (input/output) address. Amazingly, most game makers adhered to this standard. But with multimedia applications and PCs becoming popular, new problems arose.

Depending on your PC mouse, your game card may be a separate add-on card sitting in an expansion slot, part of your computer's motherboard, or part of a sound card. Identifying which type you have will make troubleshooting easier (especially *before* problems appear).

How Games Affect the Joystick

If you have a separate game card installed or if it is part of your motherboard, a game cannot affect the settings of the game card (unless your PC has a joystick setting in its CMOS setup screen). If your joystick is connected to the game port on your sound card, a game program installation or lockup could alter the sound card's configuration settings. Check the "Sound Problems and Solutions" section of this book for more information about recovering the proper joystick port settings in the sound card setup program.

Testing Your Joystick

The following procedure explains how to create and run a QBASIC program that will test both game ports for joystick activity.

1. At the DOS prompt, enter **COPY CON JOYSTICK.BAS**.
2. Type **10 PRINT STICK(0), STICK(1), STICK(2), STICK(3)** and press Enter.
3. Type **20 GOTO 10** and press Enter.
4. Press the F6 key and then press Enter.
5. The following message will be displayed: **1 file(s) copied**
6. Type **C:\DOS\QBASIC /RUN JOYSTICK.BAS** and press Enter.
7. Four columns of numbers will appear, displaying the coordinates of the X and Y axis of both joysticks.

   Column 1 is the X coordinate for joystick A.
   Column 2 is the Y coordinate for joystick A.
   Column 3 is the X coordinate for joystick B.
   Column 4 is the Y coordinate for joystick B.

8. As each joystick is moved, the X and Y coordinate values should change.
9. If no joystick or game port is detected, zeros will be displayed.
10. To terminate the program, press Ctrl+Break.

Using the IBMJOY.EXE Joystick Program

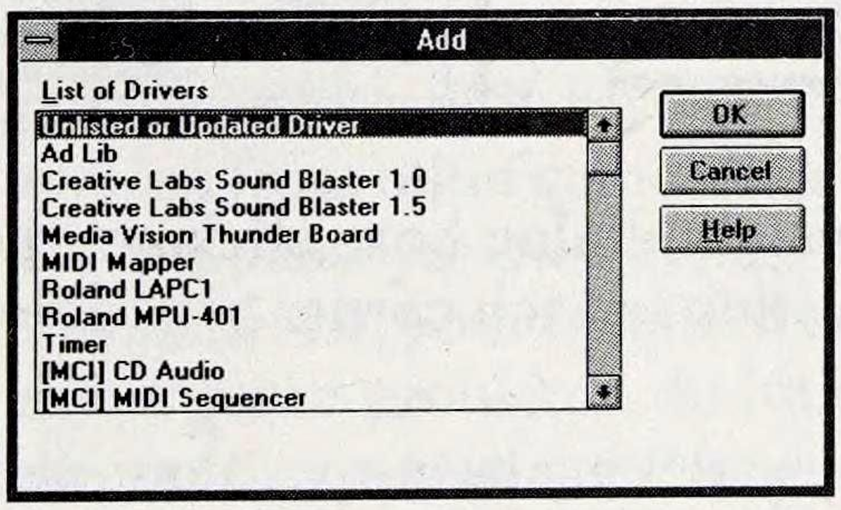
The Microsoft Download Service BBS has a free joystick testing and calibration program available for Windows game users. The filename is IBMJOY.EXE. It is a self-extracting, compressed file. When you have it downloaded, you can simply type its filename at the DOS prompt to uncompress it. When it uncompresses, four files will be created: IBMDRV.DRV, JOYSTICK.CPL, JOYSTICK.TXT, and LICENSE.TXT.

The actual device driver is the IBMDRV.DRV file. The JOYSTICK.CPL file creates a joystick icon in the Windows Control Panel. JOYSTICK.TXT and LICENSE.TXT are document files that you can view in any word processor. They provide installation instructions and licensing information.

Here's how to install the program:

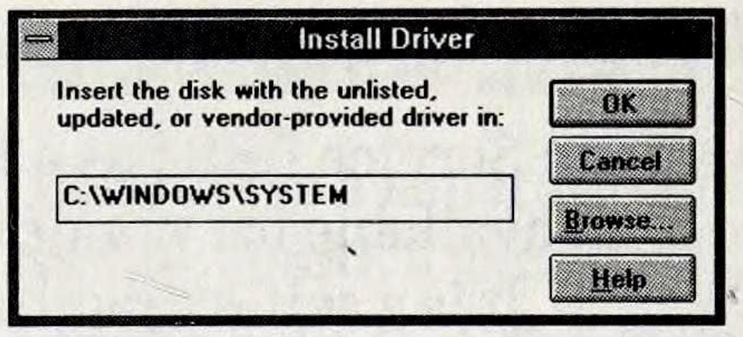
1. Copy the JOYSTICK.CPL and IBMDRV.DRV files to the WINDOWS\SYSTEM subdirectory. Then, in the Windows Main group, click on Control Panel. Double-click on the Drivers icon in the Control Panel.
2. When the Drivers dialog box appears, click on the Add button. Highlight the Unlisted or Updated Driver menu option and click on OK.

Highlight "Unlisted or Updated Drivers" and click on OK.



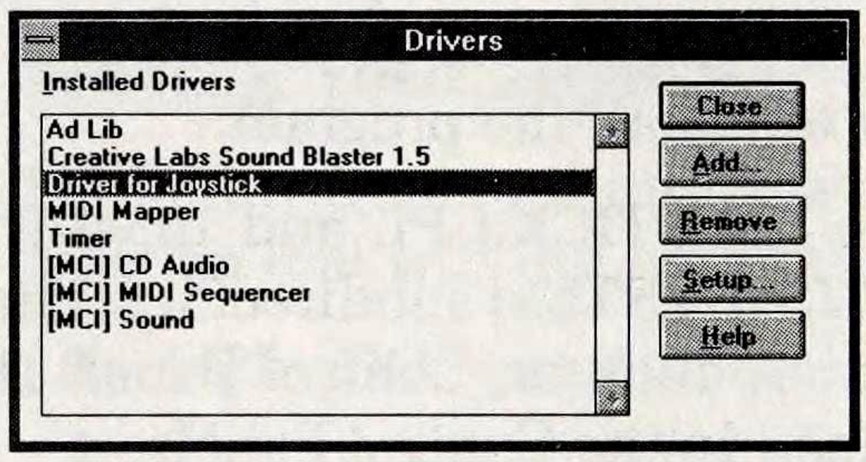
3. In the Install Driver Window, type in the directory name, **C:\WINDOWS\SYSTEM**, and click on OK. **Driver for Joystick** will appear on the menu in the Add Unlisted or Updated Driver window. Click on OK.

Enter the name of the directory where IBMDRV.DRV is located and click on OK.

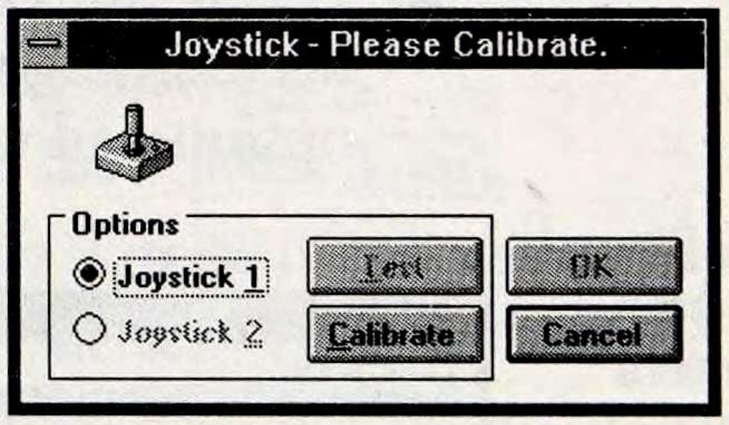


4. The Driver for Joystick option will now appear in the Drivers dialog box menu. Click on the Setup button, and a Game Adapter Setup dialog box will appear. Choose the proper joystick type and click on OK. You must exit Windows for the changes to take effect. Restart Windows, go to the Control Panel, and click on the new Joystick icon.

A new driver installed for your joystick.



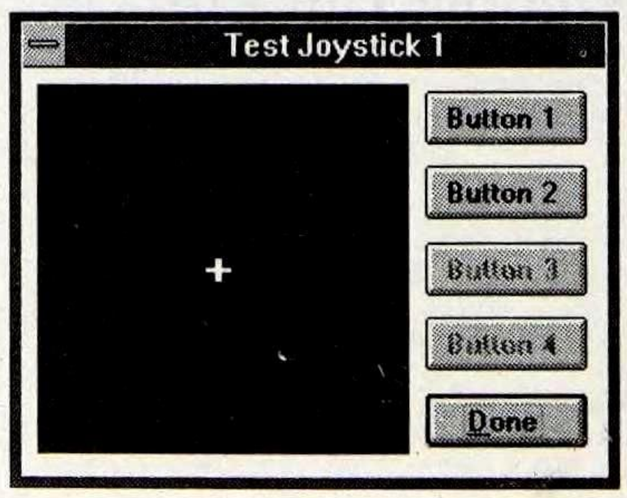
Select your joystick options.



5. In the Joystick dialog box, click on the Calibrate button. Move the stick to each corner as prompted and hit the fire button.

6. To set the joystick centering position, click on the Test button. Adjust the joystick's slider controls until the cross symbol is centered on the screen. Then click on the Done button. You can then exit from Joystick application and the Control Panel. Your joystick is now fully calibrated for Windows games.

Adjust your joystick controls so that the cross symbol is centered.



Part 10

Getting Help: Online Solutions to Game Problems

There are many technical issues that are game-specific. When you have tried every last tip, hint, and secret to solve a game problem, your next step is to get assistance from the game maker or from other users. That's why a modem is one of the most valuable tools for game troubleshooting.

Help can come in the form of the game company's own bulletin board service (BBS) or from a game company forum on a commercial online service. You can also obtain valuable information from other game users who've experienced and resolved the problem you're having. Your PC manufacturer, as well as the makers of your installed hardware peripherals, can help you solve game problems. Solutions can come in the form of answers to common questions, patch programs, an updated revision to the entire program or referrals to other hardware makers for updated device drivers.

The most popular game companies have forums on Prodigy, CompuServe, GEnie, and America Online. The reference section of this book includes the phone numbers of these online services.

Typical Game Problems and Solutions Found Online

To show how you can save time troubleshooting a game-specific problem, this section describes some of the questions, solutions, patch files, and free programs found on BBSs.

Specific company and product names are not given, but the problem issues will apply to many game programs. So, I'll represent the game company name and product titles with "*GameCo*" and "*FunGame*."

Issue

The mouse cursor leaves trails across the screen.

Resolution

This may occur with Windows-compatible games if the Windows video driver is set to display more than 256 colors. You can load a 256-color Windows video driver to correct this problem. Consult your video card manual, the manufacturer or your hardware dealer for more information. If you are not running the game through Windows, your mouse driver may not be 100% Microsoft-compatible. Contact the mouse manufacturer to get the latest version of the mouse driver.

Issue

You are playing FunGame in Windows and cannot click directly on the objects you need.

Resolution

This happens if you run Windows in a high-resolution display mode, such as 800×600 or 1024×768. A patch called "Funpatch" will correct this issue. If you have a modem, this patch is available for download from various online services, such as CompuServe, GEnie, America Online, and the *GameCo* BBS.

Issue

You are installing from a drive other than the A: or B: floppy drive.

Resolution

First, try typing **INSTALL /F**. The install program should ask for a directory to install the files to. If you're installing *FunGame* 5, you must change to the COPYDIR directory on Disk #1 before typing the INSTALL /F command for *FunGame* 5 to change to the

\DOSONLY directory on Disk #1. Next, if your floppy drive designation is not A: or B: and the INSTALL /F command doesn't work, use the ASSIGN command to temporarily reassign your floppy drive.

Issue

You hear sound but no music plays in Windows.

Resolution

If the voices are okay but the music doesn't play in Windows, the MIDI Mapper is not set up properly. If you have a Sound Blaster-compatible card, channels 13 through 16 should be active, and channels 1 through 12 should be inactive. Refer to your Windows manual or sound card manual for instructions on doing MIDI Mapper setup from the control panel.

Issue

A message appears while you are playing FunGame *in effect saying, "Oops, you did something we didn't expect."*

Resolution

There may be a patch that will solve this issue. The patch is called FUNGAME.EXE and can be downloaded from the *GameCo* BBS.

Issue

You experience a lockup when running the installation program.

Resolution

On some systems, the install program may stop when it is trying to detect the type of hardware in your system. Change to the COPYDIR directory on Disk 1 and type **INSTALL /M**. The /M switch turns off the auto-detect mode and allows you to manually select the proper hardware settings.

Issue

The voice or sound from your Sierra CD-ROM product is stuttering or cutting out.

Resolution

There are several steps you can try to fix the sound cut-outs. First, increase the /M: value on the MSCDEX line in your AUTOEXEC.BAT file. You can increase this to a maximum of 32. Second, if you are running the Windows version of the game,

you can also add the line "audioBuffs = 8" in the FUNGAME.INI file or increase the numeric value if the line that already exists. In DOS, this is fixed by increasing the Audiosize= statement in the RESOURCE.CFG file, under \FUNGAME\<game Sub-Dir>. The default is 8K; set it to 12K.

Issue

The speech on your CD-ROM program stops after the first sound.

Resolution

This usually occurs if you have a Sound Blaster 16 sound card. The company has issued an updated sound driver that will fix this problem. The file is called SB16DRV.

Issue

You are experiencing distorted graphics in games using an ATI Ultra Graphics Pro video card.

Resolution

First, make sure you have the latest Windows video drivers for your ATI video card. These drivers can be downloaded from the ATI BBS at (905) 764-9404.

Issue

FunGame *locks up and you have an IBM PS/1 or a Sound Blaster 16 card.*

Resolution

If you have a PS/1, rerun the INSTALL program from the FUNGAME directory on the hard drive and make sure you choose PC Internal Speaker for Music and No Audio for the Audio option. If you have a Sound Blaster 16 sound card, rerun INSTALL and choose Thunderboard for Audio to bypass this problem.

Issue

You get this error message: ***Unable to initialize your audio/music hardware****.*

Resolution

This message occurs when you have a 486 computer and a Sound Blaster or compatible card. The company has issued an updated sound driver called 486SBDRV.EXE that will fix this problem. It is available on the *GameCo* BBS, CompuServe, and GEnie.

Files for Fixing Game Problems

Look at what's available online for resolving game problem issues:

Some Useful Files Available Online

Filename	Number/Date	Description
CD_DOS.EXE	82423/5-23-94	MS-DOS CD-ROM Driver v4.19 - CR563. Fixes the "Not Ready" error.
QCDWU.EXE	81792/5-23-94	Quick CD v1.40 (DOS/Win3.1 CD Player) Fixes problems with some SCSI CDROM drives, and also some problems with clipping on audio tracks.
CD_WU.EXE	63772/10-30-93	Updated CD-ROM Install and Test program for the CR-563 CD-ROM Drive. Fixes the hang when used on a machine with a Western Digital Video Card.
VESADU.EXE	139131/12-30-93	A Collection of Public Domain VESA drivers for numerous video cards.
UNZIP.EXE	30581/1-17-93	Freeware Utility to uncompress .ZIP files. Capable of unzipping files compressed with PKzip v2.04g
PKZ204G.EXE	202574/10-03-93	PKzip/PKunzip v2.04g. Used to UnZip ZIP files
TM412-1.ZIP	189678/9-13-93	TELEMATE 4.12. Modem program for PCs, 1 of 4
SUPRT309.ZIP	12283/10-13-93	Technical Support BBS List for Sept 1993. Lists 360+ BBSs run by commercial and shareware hardware/software vendors for product support.
SBALIB.EXE	8605/10-03-93	SB-SOUND.COM Driver for old AdLib games
T7G130.EXE	330491/6-08-94	Patch for *The 7th Guest* by Virgin Games, Inc.

Other Online Resources

Did you know that you could download free patch software files and a complete modem communications program free of charge? Don't feel bad—most expert technicians get stumped too. But they know when to quit troubleshooting and get help from the game maker themselves—preferably online. No matter how many troubleshooting steps you take, you can never know about a game patch program or an alternative configuration or setup procedure unless you scan the technical issues sections of game forums or BBSs.

While online, you'll learn a lot more about the game for which you're getting assistance, and you'll find out about other products and services the company offers as well. If you don't see an answer to your problem, you can leave a message for a support technician to call you back to resolve the issue. An added bonus: There is usually no hold time when calling—either the modem connects or you get a busy signal. That's a definite advantage over calling support any day!

How to Go Online with the Windows Terminal Program

This section will show you how to use the Windows Terminal program to go online and obtain solutions to technical issues. I chose to describe Terminal because it is the most widely installed communications program, installed on over 50 million PCs using Windows. The instructions given will also apply to any other communications program you use. Keep in mind that this is an introduction, not a comprehensive guide to modem communications or to the Windows Terminal program.

You'll find just enough information to get you started downloading information and fix-it files. For more information about the Terminal communications program, see the Accessories section of your Windows manual. When you are in the Terminal program, you can click on the Help menu at the top of the screen for more information. If you are using another communications program, read its manual for more details.

If you do not have a modem installed in your PC yet, purchase the fastest one you can afford. You'll save the difference

in price after your first few download sessions. As an example, using a 1200-baud modem to download the SVGA.EXE video driver file would take 1 hour and 12 minutes. A 14,400-baud modem can download the file in less than 7 minutes! Imagine the money you'll save in toll calls and online service fees. You'll also have more time to play games.

Preparing to Download Files

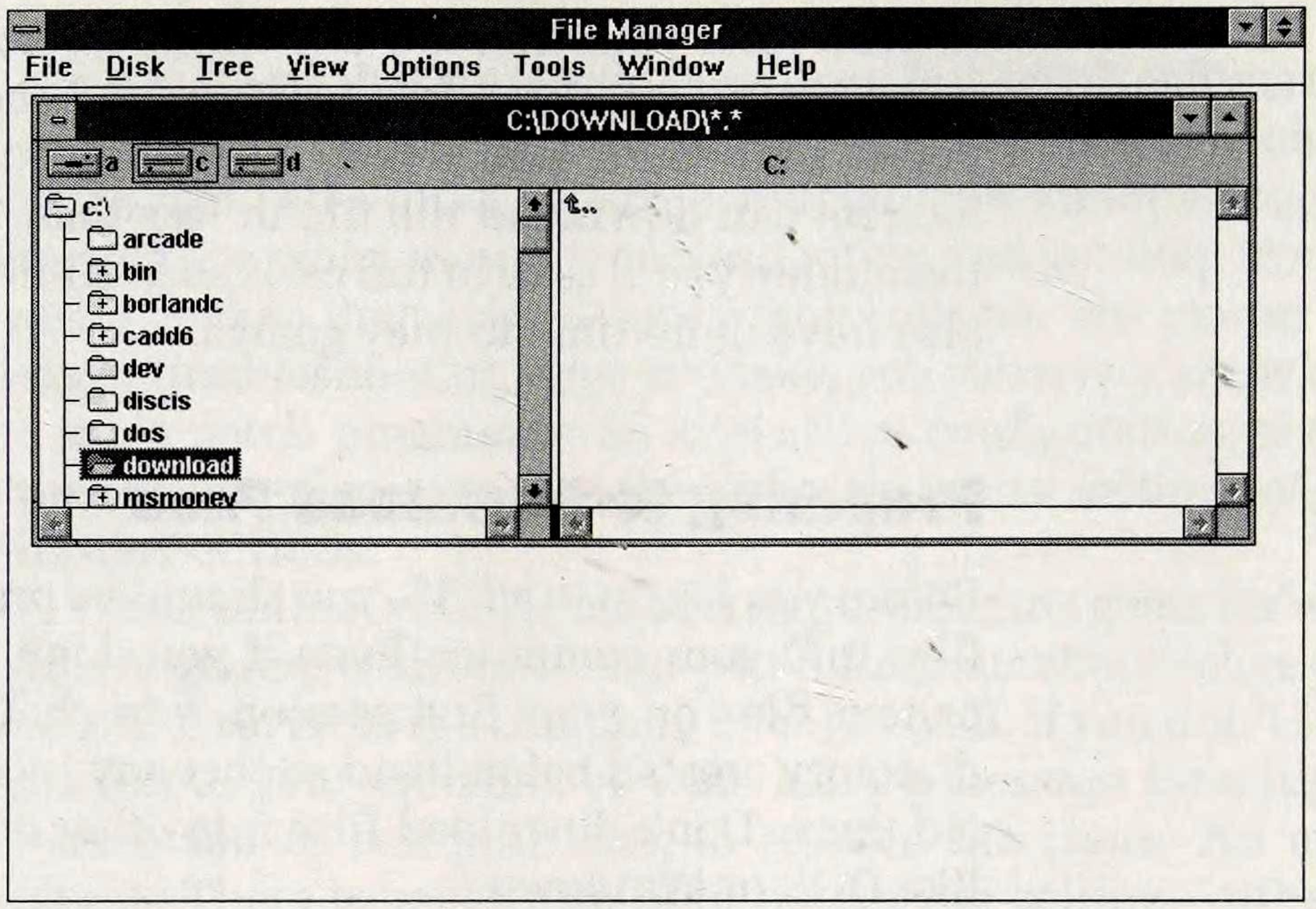
Before you log on to a BBS, you should be prepared to download files into your computer. Even if you don't download program or text files on your first session, you should have a separate directory created beforehand so that any incoming files are copied there. Don't download files into other occupied directories, like DOS or Windows.

Since your present directories already contain dozens—possibly hundreds—of files, you don't want to have to worry about which files belong to which application program. The other reason you want to keep the files separate is that many of them will be in a compressed format. When you uncompress them, the downloaded files may have the same filenames as some of your existing files (such as the ones that run Windows), and this can cause problems if the proper procedures aren't taken.

It's simple to create a directory for your files. You can do it from the DOS prompt, in Windows or from DOSSHELL.

In Windows, open the Main group and click on File Manager. In the File Manager, click on the C:\ folder icon in the top-left column. When the file folder is open, the present directory chosen is the root directory. Next, click on the File menu and select Create Directory. In the Name box, type in the directory name you prefer for the download directory—**DOWNLOAD** is a good choice. Click on the OK button, and you're finished. The directory listing, which appears in the left column of the File Manager, should show your new DOWNLOAD directory. If it doesn't, the name chosen is already being used by another directory, or if you chose a directory name other than DOWNLOAD, it may be longer than 8 characters, the maximum limit (in this case only the first 8 characters will show in the list).

Creating a new directory in the Windows File Manager.

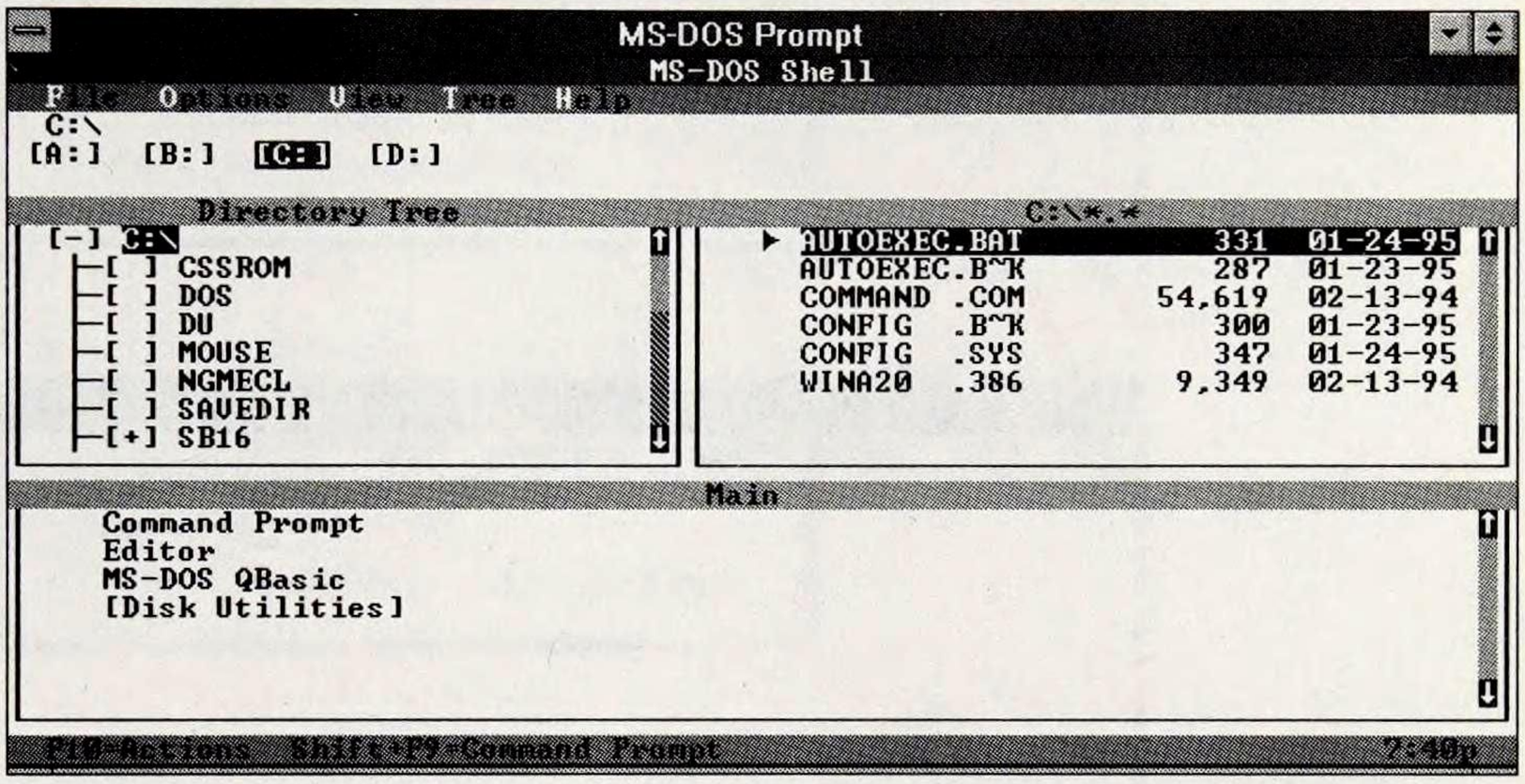


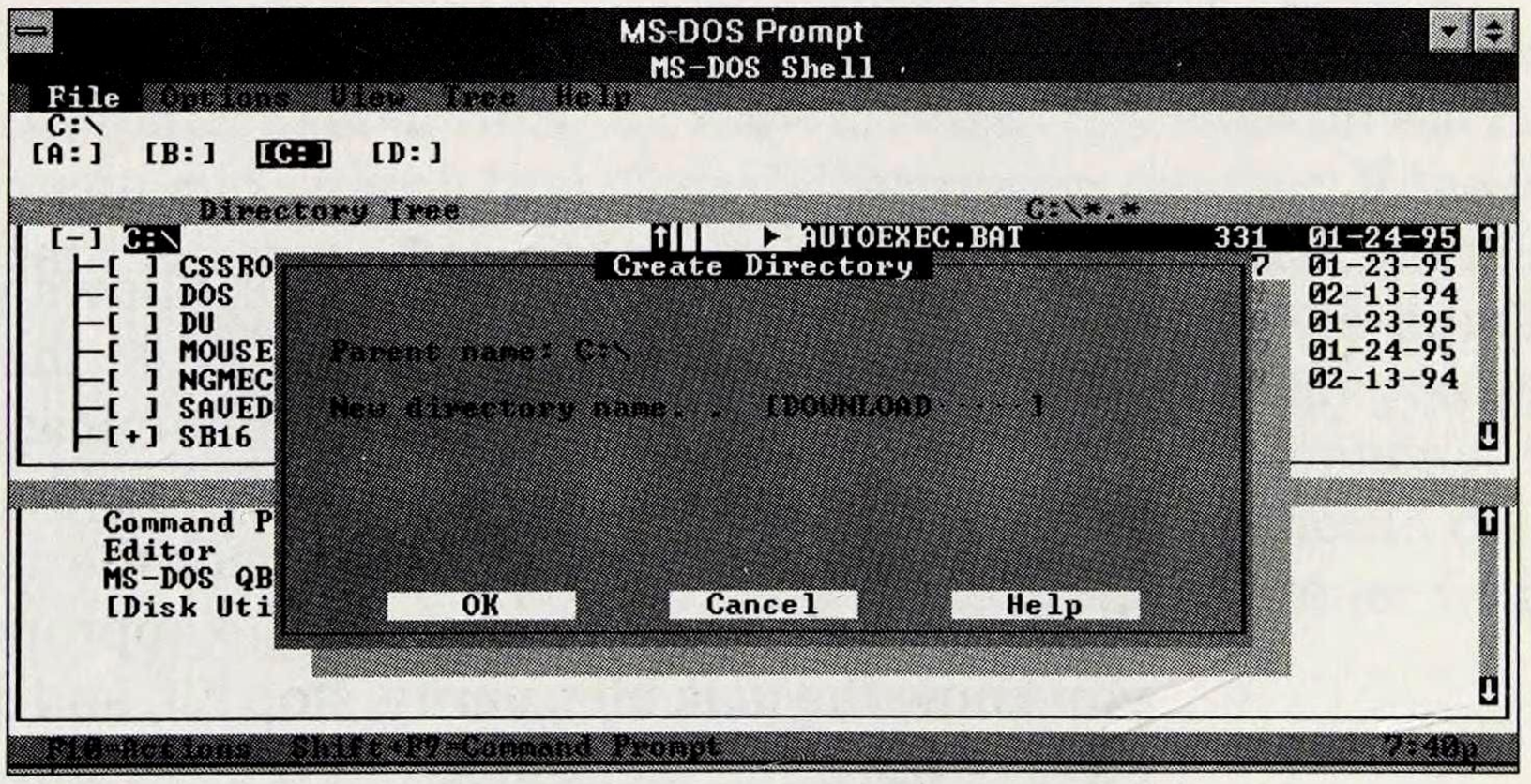
To make a directory from the DOS prompt, type **CD** to change to the root directory. Then type **MD DOWNLOAD** to create a directory called DOWNLOAD. (Substitute your preferred directory name after the MD command.) MD stands for **M**ake **D**irectory. You'll see your new directory listed if you type **DIR/P** at the DOS prompt.

You can also make a directory in the DOSSHELL program. At the DOS prompt, type **DOSSHELL**. In the DOSSHELL program, highlight the C:\ directory icon in the top-left corner of the directory listing. You can either click on the C:\ folder or hit the Tab key repeatedly until it highlights the Directory Listing section of the screen. Then use your Up or Down arrow key to select the C:\ directory.

Next, click on the File menu at the top of the screen. If your mouse doesn't work in DOSSHELL, hold down the Alt key and hit the F key to pull down the menu. Select the Create Directory option, type in the directory name you desire, and then hit Enter or click on the OK button. Then you're done. To exit DOSSHELL, click on the File menu (or hit Alt+F) and select Exit (or hit the X key). You'll be returned to the DOS prompt.

Creating a new directory in the DOSSHELL program.

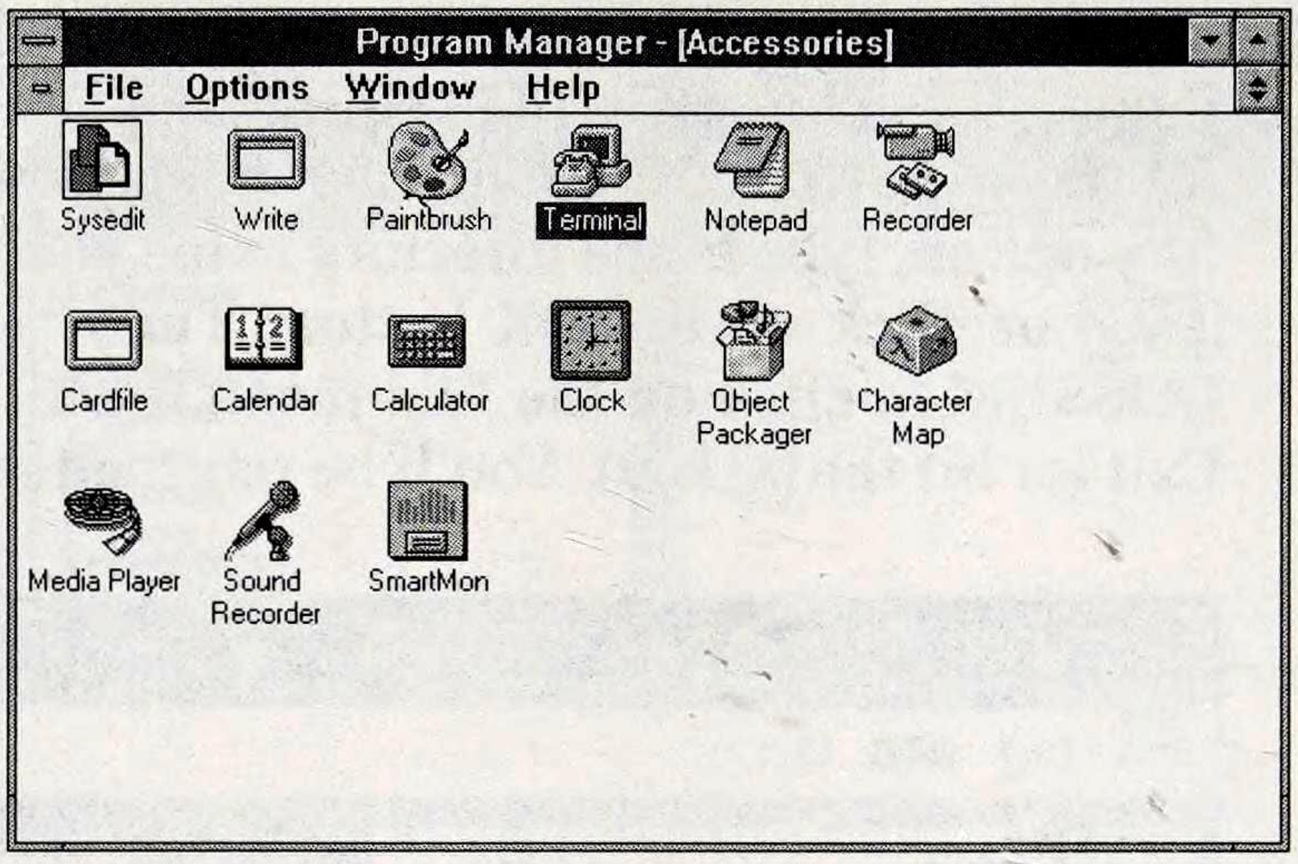


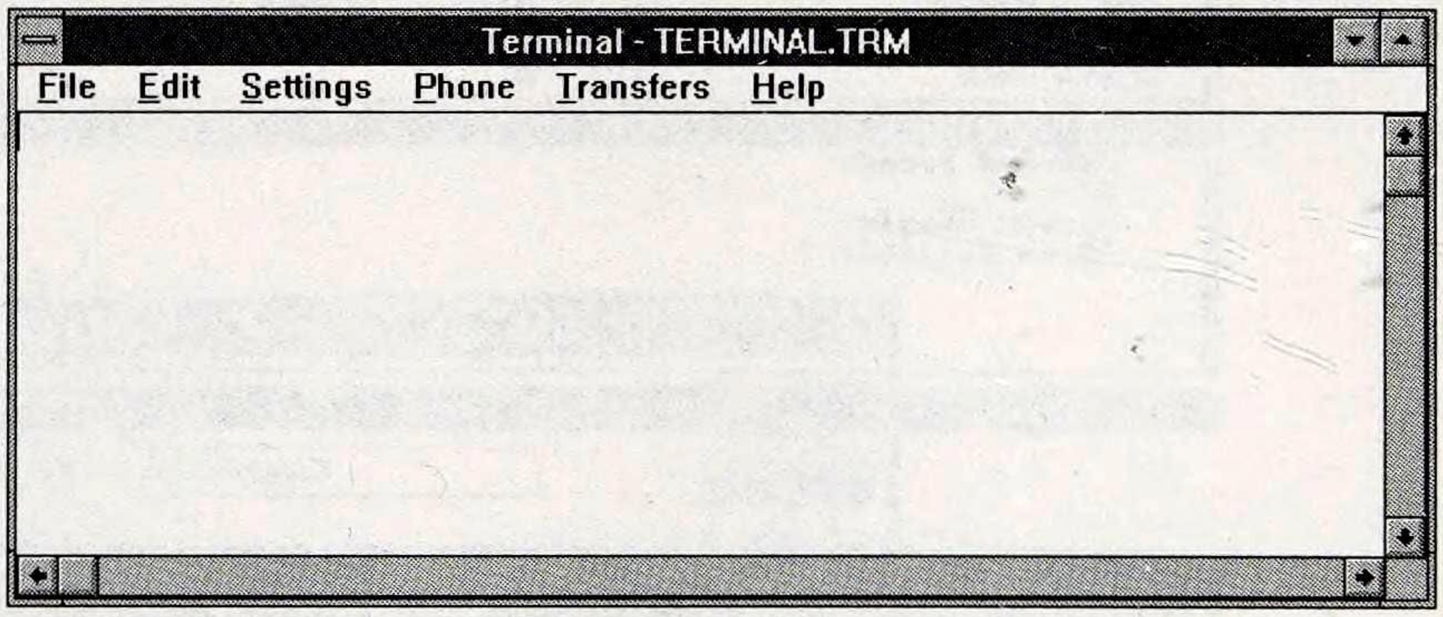


Setting Up Modem Parameters

With a separate download directory, you're ready to check your modem settings and dial a number. In Windows, open the Accessories group and click on the Terminal icon. When the Terminal screen appears, click on the Settings menu and choose the Communications option.

Choosing the Terminal icon from the Accessories group window.





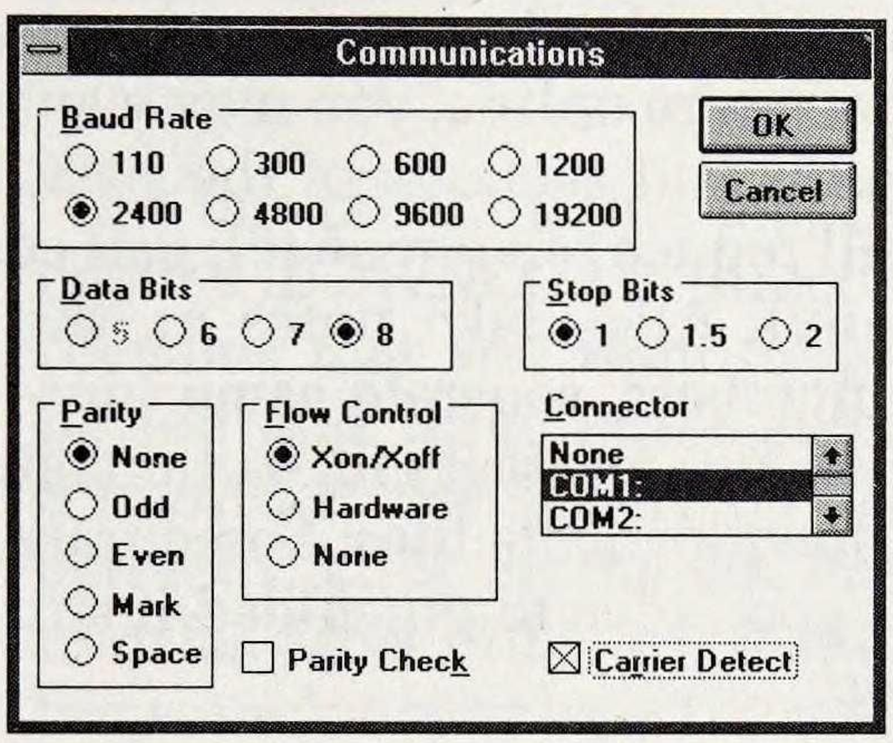
The Communications dialog box allows you to set Terminal parameters to match the modem type; the computer's active modem port and the modem communication and data transmission settings. You must know the maximum speed at which your modem can transmit data. Check the manual for details. In the Baud Rate section, click on the appropriate speed. Unless you know the data bits, parity, stop bit, and flow control parameters of the other computer you'll be communicating with, you can use the default settings that are already installed in those sections of the dialog box. These are the typical default settings:

```
Data bits—8, Parity—None, Stop bit—1 Flow control—Xon/Xoff.
```

These communications settings are used by about 85 percent of BBSs, online services, and other private communications between users.

The last setting to choose is the COM port. You'll have to check your CMOS setup screen to see which port your modem is using. Make that selection and then click on the OK button. Then you're ready to call a BBS.

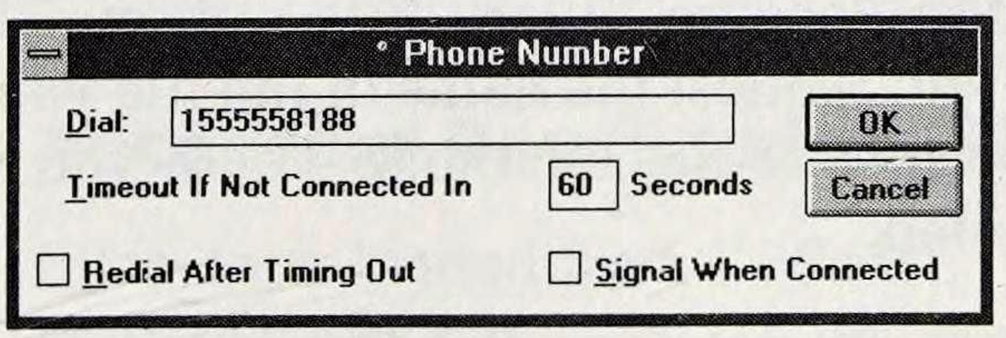
Setting the terminal configuration for communications.



Calling Online Services and Private BBSs

The next thing you have to do is dial the phone number of the computer user or BBS you want to reach. Just click on the Phone menu and choose Dial. Type in the phone number. If the number is in your area code, just input the seven-digit number. If the number is outside your area code, include the number 1 plus the area code and then the number, the same way you would when dialing a long-distance number on your telephone. After typing in the number, click on OK. The modem should dial the phone number and connect you to the other computer within a few seconds.

Inserting a phone number in the Dial option.



Most online BBSs want you to enter registration information the first time you connect with them. The program will request name, mailing address, and phone information. You'll also be prompted to enter a user password a couple of times. On future calls, you can simply enter your name and you can check your private mailbox (if any) for messages.

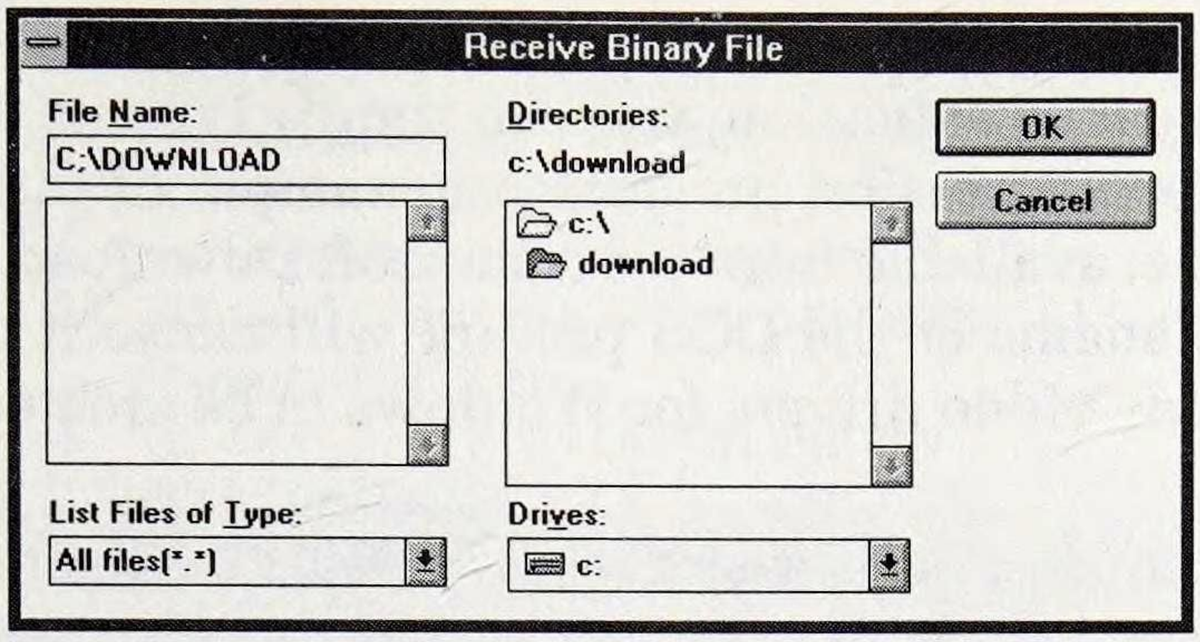
Most online services and private BBSs are simple and straightforward to use. They are usually menu-driven and have a Help key available to provide instructions for navigating through its system. When you're online, you may want to take notes about the main menus and sections of the BBS, including shortcut keys. This will reduce telephone toll call costs and save online charges (if any). Also, take notes on the company mailing address, fax numbers, separate game hint-line numbers, message forums to leave messages for technicians, customer forums and a list of downloadable files. Sometimes the file list can extensive; it's a good idea to download it and read it later, when you're off-line.

Downloading Files

When you've located the file or group of files you want to download, you must request it from the BBS program. This may be a simple command like hitting the D key on your keyboard, or it may be a multiple-step procedure. When you have properly tagged the files (indicating that you want them to be transmitted to you), you must command the Terminal program to download the files.

To download files in Terminal, click on the Transfers menu. The choices you can select are Receive Text File or Receive Binary File. If the file you are going to download is a text or document file, choose Receive Text File. If the file you want is a program file, choose Receive Binary File. In this example, we've chosen the Receive Binary File option. The dialog box that appears will request the name of the file you wish to download and the name of the directory where you want the file to be downloaded.

The Receive Binary File option.



At this point, ensure that the directory listed is your newly created DOWNLOAD directory. Then type in the complete filename that you want to download: Be sure to include the period and three-letter extension with the filename (e.g., SVGA.EXE, not simply SVGA). When everything is typed in correctly, click on the OK button. The file(s) should begin to transfer. Most BBSs will display the file size and the estimated transmission time based on your modem speed. When the downloading routine starts, you may see the amount of bytes that have been transmitted updated every few seconds.

After you've received the files you want, you can look around other areas of the BBS or log-off (hang up).

If the file you've downloaded has a ZIP extension, that means that the data in the file has been compressed. You'll need a copy of the PKUNZIP program in order to uncompress the file. Most download services and BBSs have this file available along with a document file to explain how to uncompress files in this format. When your session is finished, simply return to the main menu and select the Log-off or Hang-up command. The files you downloaded are in the DOWNLOAD directory, ready to be used.

Accessing Downloaded Files

Files downloaded from BBSs will vary considerably. They can be patch programs, device drivers, text files, small programs, graphic files or other types of files. Most of them will be in a compressed format. There are two ways to uncompress *most* files obtained online: The file that you download has its own

decompression code built into the file. If the filename ends with the EXE extension, you can simply type its filename to start the decompression process. An example of this is the SVGA.EXE file, available from the Microsoft Download Service. Typing its filename at the DOS prompt will cause it to expand and five new video drivers for Windows to be created.

When uncompressing Windows files, it is important *not* to do it while you are in the Windows directory or from the Windows/System subdirectory. If any files created during the uncompression routine have the same filenames as existing Windows files, you can lose the original versions. Alternatively, the file will not uncompress completely.

The other uncompression method is to use the PKUNZIP program to uncompress files with the ZIP extension. You must have the PKUNZIP program loaded on your computer either in the DOS directory or in the DOWNLOAD directory. Using it is simple: Just type **PKUNZIP** and then the name of the file you want to uncompress. For example, to uncompress a file named INFO.ZIP, change to the directory it's stored in and type **PKUNZIP INFO.ZIP**. The file will start to expand, and you'll be left with a larger file or a group of files. Check the directory listing for a README.DOC file or a similarly named text file that may have been created. If you find such a file, read it in a word-processing program for further instructions.

PKZIP, used for compressing files, and PKUNZIP, used for uncompressing them, have other commands and features you can take advantage of. For more information, type **PKUNZIP** at the DOS prompt. You'll see a list of optional commands and a mailing address. You'll be prompted to register the program to receive a complete manual and future upgraded versions. The screen display looks like this:

```
Usage:  PKUNZIP [options] zipfile [@list] [files...]
-c[m] extract files to Console [with More]
-d restore/create Directory structure stored in .ZIP file
-e[c|d|e|n|p|r|s] Extract files.  Sort by [CRC | Date
| Extension | Name
| Percentage | Reverse | Size]
-f  Freshen files in destination directory
-j|J<h,r,s> mask|don't mask <Hidden/System/Readonly>
files (def.=jhrs)
-n extract only Newer files
```

```
-o Overwrite previously existing files
-p[a/b][c][#] extract to Printer [Asc mode,Bin mode,
Com port] [port #]
-q Enable ANSI comments
-s[pwd] Decrypt with password [If no pwd is given,
prompt for pwd]
-t Test .ZIP file integrity
-v[b][r][m][t] View .ZIP
[Brief][Reverse][More][Technical] sort by [CRC|
  [c,d,e,n,o,p,s] Date|Extension|Name|natural
Order(default)|Percentage|Size]
-x<filespec>  eXclude file(s) from extraction
-$ Restore volume label on destination drive
-@listfile  Generate list file
If you experience difficulty with PKUNZIP, please
consult your manual.
If problems continue, please document the problem as
well as possible
and contact PKWARE technical support.
9025 North Deerwood Drive
Brown Deer, WI 53223
Support BBS: 414-354-8670
Fax: 414-354-8559
```

Downloading Files from the Microsoft BBS

If you have Windows installed on your computer, you can obtain updated device drivers from the Microsoft Download Library (MSDL) BBS to solve common problems. The phone number for the MSDL is (206) 936-MSDL (936-6735). There is no connect-time charge for using this service.

On the MSDL, you can obtain a master file list of all of the updated device drivers. The file is called WDL.TXT (**W**indows **D**rivers **L**ibrary **Text** file). You can view the file while you're online or download it and view it later to save long-distance phone charges. The WDL.TXT file includes a list of updated device drivers and programs This file is updated on a regular basis.

All the drivers included in this library are intended for use with Windows 3.1. These drivers are *not recommended* for use with Windows 3.0.

On CompuServe, the WDL file is in the Microsoft Software Library, which can be reached by typing **GO MSL** at the system prompt. (To find WDL.TXT, search on S13354.) On the GEnie and Microsoft OnLine systems, the WDL is in the Microsoft Software Library. (To find WDL.TXT, search on S13354.)

Do not download files directly into your WINDOWS directory. Doing so could overwrite files essential to the proper operation of your system.

The file you download is the executable or program (EXE) file. This file contains all the files you need to support your device. Download the EXE file to your floppy disk or to the new subdirectory you created on your hard disk. Change to the floppy disk drive (or the subdirectory on your hard disk) that contains the EXE file. At the MS-DOS prompt, type the filename and then press Enter.

When the EXE file finishes running, all the files you need to support your device, such as a DRV file and an OEMSETUP.INF file, are set up. You are also provided with a TXT file that contains instructions for installing the device drivers (or other software) and a licensing agreement. If you have problems extracting the files, try downloading the original files again.

Part 11

Getting the Most From Technical Support Departments

After you've tried every technique to get a game running and you've triple-checked your hardware, software, utilities, and other peripherals, it's time to contact the company's technical support department. The problem could be caused by a faulty disk or a bug in a program that cannot be resolved without obtaining a new version of the software from the manufacturer.

Technical support departments exist to help you resolve any problems you are having with their product. They can give you hints, secrets, clues, and other information about known conflicts with their own and other manufacturer's hardware and software products. Support departments are also a good source of data on device drivers, patch programs, and upcoming releases of new and related game titles. To get the maximum benefits from technical support, you need to prepare before you contact the company.

Some problems encountered with technical support departments can be traced to the method of contact. Experiences with constant busy signals and extremely long hold times can be prevented with a few preliminary steps before contacting—not necessarily *calling*—a company's technical support department.

This section will show you how to get the most from tech support. I start with a checklist to work through before you contact

them. Then, you'll get tips on what type of contact to make with the company and what to do while waiting for an answer. The chapter ends with suggestions on how to get the most information for your time and money to solve the immediate problem, and how to inquire about other known conflicts or bugs that may cause conflicts later.

How to Prepare for a Support Call

Tech support is most useful in solving *identifiable, recurring* problems. Isolated incidents of strange program behavior or lock-ups aren't worth making a call about.

Identifying and Isolating the Problem

You must locate where the problem occurs. Write down the specific events that happen and where they occur. Note when the problem happens—at bootup time, during the installation process, while a program is loading, when the game displays a certain graphic, when a sound is played, when a special play function is selected, and so on.

Also, check the game configuration settings and experiment with them. For instance, change the video driver installed in Windows (if possible) or change the sound card setting and note the reaction. See what happens when memory is reconfigured. Make a note of all of the changes you make and what results you get. You'll be surprised at what becomes evident when you go through each step logically and experiment. Even if you don't resolve the problem, the information you gather will save the support technician troubleshooting time.

Telephoning as a Last Resort

When you've determine that you have an inexplicable problem with your game software, it's time to decide the best avenue for contacting the technical support personnel. A phone call is just *one* way of getting information from them. If possible, it should be the *last* choice.

Hardware and software technical-support departments are constantly swamped with calls. Any way that you can prevent

calling them will help you, the company, and other users. To understand why, I'll relate how the industry has changed in just the past few years.

1. In early 1992, PC-compatible computers started to show startling sales gains. Later that year, Windows 3.1 was released and was a huge success. Unfortunately, many users didn't read the manuals and learn basic DOS and Windows concepts.
2. Windows software application sales skyrocketed. As hardware features and power rose, prices fell, causing PC sales to continue climbing. More and more first-time computer buyers entered the market.
3. Sales of inexpensive sound cards, CD-ROM drives, and multimedia computers climbed. Even more new users entered the market. Their learning curve didn't match the rate at which new software programs were released.

   - Multimedia PCs and after-market multimedia upgrade kits sales continued to grow tremendously. Even *poorly tested* software and add-ons sold well.
   - Non-computer media companies flooded the market with CD-ROM versions of music videos, movies, books, mystery games, adult entertainment, magazines, how-to reference guides, and other interactive multimedia applications. Manufacturers focused less on low memory requirements, device driver compatibility, and clear documentation with troubleshooting information than they did on gaining market share.
   - With multiple hardware peripherals (video card, sound card, CD-ROM) and a plethora of device drivers, operating system versions and utility programs installed, customers had to call *many different* tech support lines to resolve their computer problems.

In the early 1980s, there wasn't much that could go wrong when you tried to load a program. If the computer would boot up, and if the software disks were okay, the program would very likely run fine. But in the '90s, when you have a PC running programs with a multitude of device drivers in a multitasking environment such as Windows, each component in the hardware and software chain has to be tested with each of the others, and

all of them must be in perfect condition. Just one corrupted program file or outdated device driver can bring the whole system crumbling down.

With this in mind, you can see that technical support companies would be overwhelmed with calls even if the calls were just hardware-related. But factor in all of the software-oriented problem issues mentioned, along with consumer naiveté and users who call for game "secrets and hints," and it's a wonder that you can get through to support lines at all.

I tell you all of this to convince you to do the best you can *before* you resort to contacting tech support: Obtain and install the latest device drivers for your installed hardware; use the pre-purchase steps given in the "Pre-Game Loading" section; and keep track of all of the system file and configuration changes you make to your system so you'll have a point of reference later.

Preparing to Make Contact

When you're ready for outside assistance, you need to prepare a few materials to reduce the call time. With your troubleshooting log, you'll also need to compile all of the numbers from the back or bottom of the PC and monitor. Find and have available all of the paperwork that was included with the PC and the game. Your system checklist should include:

- **PC Specifications**—Motherboard type, speed, CPU, RAM installed, hard-drive type and size, CMOS setup screen information. Keep the owner's manual handy.
- **Peripherals Installed**—Jot down the name and specifications of your video card, sound card, CD-ROM drive, and second hard drive. List specifications on each hardware device (I/O address, IRQ, and DMA channel). Note device driver versions used to operate each device installed.
- **Software and Utilities Installed**—DOS version installed, memory managers or compression software installed, menu or program environment (Windows) used, amount of free disk space, and printed copies of your CONFIG.SYS and AUTOEXEC.BAT files.

- **Game Specifications**—Version type, serial number, registration information, purchase date and location, and results when loading and running.
- **Problems You've Experienced**—Write down in chronological order what you attempted and what results you got. Be clear and concise. Keep this information at the top of your list for quick access.

Once you have everything ready, you have to decide who you're going to contact and how. This decision may not be as obvious as it sounds. For instance, if you can test the game on another PC and it runs fine, you may want to contact your PC manufacturer for known conflict information or to receive updated device drivers that will alleviate the problem. In some instances, you may need to call more than one company.

Speaking of calls, you should find every alternative contact method for all of the hardware and software companies associated with your system. Make a note of fax numbers, BBS numbers, and forums available on commercial online services. See if your dealer can make the call and fix the problem for you; no doubt other customers are experiencing the same problem. Also, obtain the business address and contact names for receiving technical support.

If you do contact a company using one of these alternative approaches, be sure to give your name and address, basic information about your system, the type of software you're using, and a detailed description of the problem you've encountered. Also include the time of day you can be reached, including the time zone where you live.

How to Converse with Support Personnel

Technical support calls can be expensive and time-consuming, another reason to try an alternative method of contact such as going online. But when there is no other option available, you should know the techniques to use to get the *maximum benefit* for your time and money

If your choice is to call the game manufacturer, be certain that your machine, device drivers, and related software are in

good working order. If possible, try to load the game on another PC and note the results and that PC's configuration information. Try to obtain as many telephone numbers for the game company as you can. Get the current telephone numbers from the game vendor or other retailers in your area that sell it. Be aware that the company may have separate lines for their administrative offices, ordering and distribution, hints and tips hotline, and tech-support line.

If you know the company's tech-support hours, try to call during off-peak hours whenever possible (ask them what those time periods are, as they vary from one company to another). Just before you make the call, review the following items on your checklist and keep a piece of paper and pen handy so you can take notes.

- **Know your support eligibility**. Go over your product documentation to check for technical support time and fee arrangements. Some products may have free technical support for a limited time. Others will also have fee-based support available after the initial support period is finished. Also, check if the free technical support period starts on your purchase date or after the first call to tech support. (I recommend that you check on warranty and support periods and fee issues before you buy.) Some games or computer hardware purchased as gifts may be unavailable for support if you don't have all of the receipts for the item. You should fill out and forward any registration cards as soon as possible to keep your support eligibility current. Doing this may also qualify you for free version updates or bug patch disks. Keep a record of all serial numbers attached to all of your hardware and software products for quick reference.
- **Have all of your materials ready**. Have a notepad ready with the problem written down, including the methods you used to resolve it. List the results you got. This will come in handy; when your call is answered, you'll immediately know what to say and in what order to say it. Keep the PC owner's manual, the hardware configuration and other technical data ready for review.

- **Prepare to open the case**. If the problem involves a hardware peripheral inside the computer case, be prepared to open it if the technician asks you to. If your monitor is sitting on top of the PC, move it. If the PC is on the floor, move it so it is easily accessible from all angles. Look at the case cover screws and get an appropriate screwdriver (but don't remove any screws yet). Be ready to turn the PC around to check cables and connections if requested to do so.
- **Have all of your PC accessories ready**. If your PC speakers require batteries, have fresh ones installed. If they use an AC adapter, be sure it works properly. Have other software diskettes, CDs, and formatted floppy disks available.
- **Telephone techniques**. Place the telephone next to the computer. If you have call-waiting on your phone line, disable it temporarily so you're not interrupted during the call. If you have a speaker phone (or a telephone headset), use it for more comfort and so you'll have your hands free to take notes or work on your hardware.
- **Ready, set, relax**. Get comfortable and prepare yourself to be on hold for awhile. Involve yourself mentally in another activity to take your mind off waiting. Turn on the TV or stereo or read a magazine. This will make the time pass faster.
- **Put yourself in the other guy's shoes**. While you're waiting, get into a relaxed mood. Prepare to converse with the support technician in an upbeat, positive manner no matter how you really feel. Consider the technician's point of view. They deal with complaints from customers all day long. Most of the problems are not the fault of the product (it's usually caused by a hardware or TSR conflict, memory configuration or user error). They will welcome and *react positively* to an upbeat, courteous caller. Establish a pleasant rapport with the support technician. Remember that your call is probably being logged, and a record of your call will be there for the next time you contact them.

Contact Time!

Finally you are put through to a support technician. Greet them and give them your name and phone number in case you get

disconnected. They will probably request other customer information as well. Grab your notepad and relate the problems you've had in chronological order. A short description of what you're trying to do and the results you receive is fine.

Be sure you inform the support person what hardware is installed in your PC and what utility software is running at the time. These issues can save valuable troubleshooting time for both of you. Here are some things you should immediately identify to support personnel:

- Extra hardware installed—for example, a sound card, CD-ROM drive, tape drive, network card, scanner, modem or video card
- Commercial memory management programs such as 386MAX, NetRoom or QEMM
- Compression software installed, such as DoubleSpace, DriveSpace, SuperStor or Stacker
- Commercial or DOS hard-disk cache programs, like SmartDrive
- Operating system type and version

Listen carefully and take notes as you are instructed to perform certain troubleshooting steps. Write quickly and do what is asked of you. The support person wants to fix your problem as soon as possible and then get on to another call. Be clear and specific to the technician about your situation and tell them about any related troubleshooting techniques you've performed that related to the situation. Volunteer your technical expertise level so the call can proceed at the proper pace. Most of the time, the problem will be solved with one call. Or, you'll get the required information to obtain any additional items necessary to complete the fix.

Problems with Tech Support

Sometimes you'll have difficulties getting the game problem solved. The reason could be technical or a problem communicating with the support technician. When this happens, you have the option to request to speak with another technician or a lead technician.

A lead technician can either perform the troubleshooting steps or connect you to another technician to try to resolve the problem. If there is still no progress being made, ask to be connected to the technical support manager. If that isn't possible at the present time, request that the manager call you back to finish troubleshooting the problem.

When a call back is necessary, be sure you get the technician's full name and also the case number (if any) assigned to your call-back log entry in the company records. That way, if something goes wrong, you can contact the company again and give the next person who answers specific times, dates, names, and case numbers quickly to get things moving fast.

Hopefully you'll attain a final solution to your problem. If you have the time, write a letter to the company thanking them for their help—*especially* if the cause of the problem was not in their product. The company, the support department and especially the individual technician will appreciate a positive correspondence. It makes the time spent with customers worthwhile.

Tech Support Extras

If you have to contact a support department, you can make good use of the time and money spent on your call by requesting additional information. Before the call is over, request the following information concerning your game or PC to get the most value from your call:

- Ask about known conflicts with hardware or software, bugs in programs, and available solutions.
- Request information about upcoming patch disks or new versions of the game and related programs.
- Ask whether the company has a BBS available or a forum on a commercial online service like CompuServe, Prodigy or Genie.
- Ask if the company can put you on their mailing list for updates on products. Also, make sure your product is registered with the company.
- Request info about any company-produced newsletters, clubs, user groups or other customer affiliations you can join.

Conclusion

Until true plug-'n-play computer hardware and software appears, those who use PC-compatibles must live with plug-'n'-pray! Because of a need for backward compatibility with the original IBM PC design, progress in speed, graphics and sound (along with a myriad of other exotic input/output devices) can only be attained with the addition of peripheral cards, plug-in accessories, and device drivers. Some game software companies are responding to user feedback by developing products that are more user-friendly. Unfortunately, there are no uniform software-industry loading procedures with specific technical requirements.

Adding to this problem is the sheer number of new software makers that want a share of the market. At this printing, the PC is becoming a common appliance for home business, educational and entertainment needs. As discussed in the Introduction, many multimedia applications are not tested extensively enough to load and run on a variety of computer hardware and software configurations. A computer user's only hope is to learn the basics of software-loading problem troubleshooting and to keep up with the product-specific bugs by scanning the bulletin board services from time to time.

A Few Parting Tips

Luckily, most game software problems fall into only four categories: memory, storage, video, and sound. Once you've experienced a few game-loading problems and logged your results, you'll know how to verify your hardware and software setup configurations to isolate the problem. Your troubleshooting experiences will pay off in future game installation routines. Here's a few parting tips you can use:

1. **Know your system.** Use the log sheets in the reference section to record configuration information for game setup information, the type of hardware the computer uses and other pertinent data. Ensure that your computer hardware components (including add-on peripherals) can all perform to the maximum of their capabilities. Run the CHKDSK/F command often to check for available memory and to prevent lost allocation units. Use the sound card test utilities. Check your CD-ROM drive with a variety of disks and run different types of Windows programs to check its operation.
2. **Back up your files and check for viruses.** Scan for viruses and update your virus software on a regular basis. Make backup disks and print out copies of your AUTOEXEC.BAT, CONFIG.SYS and important Windows system files. Install Windows games in a separate version of Windows. It's easy to troubleshoot post-installation problems when you have a reference point to check against.
3. **Voice your frustration.** If you determine that a problem is game-specific, check with their technical support department for a solution. If the problem is one of unusually high technical requirements, let the company know with a letter, a phone call or a posting on their BBS. Share your experiences with other users via BBS postings, too. Game companies that want to be competitive and stay in business will respond. In fact, the manufacturer of a very popular CD-ROM game (it involves a mystery in a haunted house—the last word in its title rhymes with *Quest*) has responded to user complaints about the necessity of obtaining a VESA video driver and its large conventional memory requirements. The company produced a patch program that includes more VESA drivers; solves system lockup and sound problems and allows the game to load with only 450K of conventional memory.

Going Further

Don't stop your quest for PC troubleshooting knowledge with the *Computer Gamer's Survival Guide.* You should further your knowledge of PC hardware, MS-DOS, and Windows with supplementary guidebooks. Scan the BBSs periodically for new information, and you'll have a great foundation for solving virtually any game problem.

Glossary

A

Active Matrix Display used for LCD displays. Active matrix displays have a transistor for each monochrome or RGB (red, green and blue) dot.

Adapter Segment The same as the upper memory area.

Aliasing Image distortion associated with signal sampling. A common form of aliasing is a stair-stepped appearance along diagonal and curved lines.

Amplitude The volume or strength measurement of a sound wave.

Analog A representation of sound (or video) by an electrical signal where the amplitude is proportional to the signal voltage and the frequency of sound or variations in brightness are represented by the signal's rate of change of voltage.

Application Software Programs that perform specific tasks such as accounting, word processing, and database management.

Aspect Ratio The relationship between width and height. When an image is displayed on different screens, the aspect ratio must be kept the same to avoid "stretching" either vertically or horizontally. For VGA and INDEO video, the aspect ratio is 4:3, yielding 160 × 120, 320 × 240 and 640 × 480 sizes.

AUTOEXEC.BAT A batch file that DOS searches for when booting up the computer. If AUTOEXEC.BAT is found, DOS will automatically carry out the commands contained in the file.

Auxiliary Audio A set of multimedia functions used to control the audio mixer of MPC-compatible sound adapter cards. The term is also used to describe audio devices whose output may be mixed with WaveAudio or MIDI audio outputs to form a composite sound source.

AVI (Audio/Video Interleaved) The Microsoft application programming interface (API), designed to compete with Apple's QuickTime methodology. AVI techniques provide a software synchronization and compression standard for audio and video signals competing with DVI.

B

Bar In musical notation, a synonym for *measure*. A bar is a grouping of notes corresponding to the number of rhythmic beats indicated in the denominator of the time signature.

Basic Synthesizer Standard The minimum sound synthesis capability of an MPC-compliant audio adapter card. The basic requirement is that three melodic timbres assigned to channels 13 through 15 and two percussive timbres assigned to channel 16 be playable simultaneously.

Batch File Files that save you from having to retype often-used commands. With a batch file, you just type in the batch file's name, and the PC carries out the commands contained in the batch file as if you had typed them from the keyboard. It is like a DOS macro, yet it does not need a special program to run.

Binary A number system in which only two numbers, 0 and 1, represent all possible mathematical values. Computers use the binary number system because 0 and 1 represent what a computer best understands—on and off.

Bit The smallest unit of data recognizable by the computer. Eight bits equal one byte.

Bitmap A graphical display image that is segmented by small square areas—bits. The more bits used, the higher the screen resolution (and the higher the memory/disk space required to produce the image).

Bootup The term describing the series of steps that takes place when you turn on the computer. In the bootup process, the operating system—DOS, for example—is loaded into the computer's internal memory (RAM).

Brightness The balance of light and dark shades in an image.

Buffering The process of using buffers to hold data being moved to or from I/O devices such as serial ports and disk drives.

Buffers A reserved part of memory where data is held temporarily until the data is transferred from storage to another location in memory.

Bulletin Board System (BBS) A computer, modem and communications software program set up to allow users to call in to post messages, communicate online and download files.

Bundled Software Software sold with computer hardware and included in the system's total price.

Bus Mastering A method by which a device, such as a hard drive or network adapter, does its own memory addressing without going through the system's processor or its DMA (Direct Memory Access) controller.

Byte Consisting of eight bits, a byte is the amount of storage space necessary to hold one alphanumeric character—the letter A, the number 5, a comma, a question mark, and so on.

C

CD (Compact disc) CDs are the original format for distributing compact optical discs for audio reproduction (CDAudio). This early format was jointly developed by Phillips N.V. and Sony Corporation and is described in Phillips N.V.'s Yellow Book. Control of Yellow Book CD-ROMs, such as starting and stopping the drive and file selection with the computer, requires Microsoft's MSCDEX driver.

CD-DA (Compact Disc-Digital Audio) Also called "Red Book" audio. CD-DA requires compatibility with MPC specification 1.0. It enables interleaving of audio with other types of data, so recorded sound can accompany images. Microsoft's MSCDEX driver is needed to play these CDs.

CD+GRAPHICS A format in which the subchannel(s) of an audio CD contain graphic images that may be displayed on a computer or a TV set.

CD-I (Compact Disc-Interactive) CD-I refers to a class of CDs primarily designed to be viewed and manipulated by users on conventional TV sets by means of a CD-I player. CD-I formats are covered by Phillips N.V.'s Green Book specification.

CD+MIDI A format in which the subchannel(s) of an audio CD contain data in standard MIDI file format that may be routed to a MIDI OUT connector and played on external MIDI synthesizers or internally by audio adapter cards.

CD-MO (Compact-Disc Magneto-Optical) Magneto-optical CDs and CD-ROMs are capable of multiple uses because they can be erased and re-recorded. The standards for CD-MOs are incorporated in Phillips N.V.'s Orange Book 1 specification. CD-MO technology is used for high-capacity 3.5-inch floppy disks, sometimes called "flopticals."

CD-ROM Compact disc, read-only memory. A form of data storage that uses laser optics rather than magnetic means for reading data. Data CD-ROMs look similar to the audio CDs available in music stores.

CLV Constant linear velocity. Spiral format of audio compact discs and some video laser disks.

COM Port A port on the rear of the PC for communications access with a peripheral device such as a modem, mouse, printer or scanner.

Composite Video Describes the method by which color information (chrominance) is added to a conventional black-and-white (luminance) signal to create a standard NTSC TV signal.

Composite Video A video signal format that includes the complete visual waveform, including chromanance (color), luminance (brightness), blanking pedestal, field, line, color-sync pulses and field-equalizing pulses.

Compressed Video A digital video image or segment that has been processed using a variety of computer compression algorithms and other techniques, thus reducing the amount of data required to accurately represent the video content.

Communications Software Modem software that allows the PC to communicate with the modem and configure it for data transmission over cables or a telephone line.

CONFIG.SYS A text file DOS consults at system startup. This file contains commands that tell DOS how to communicate with new hardware, how to customize communication with existing hardware and how to adjust the computer's memory usage.

Contrast The measure of the range of light and dark values in an image.

Conventional Memory RAM (random-access memory) that DOS uses to run software programs. Conventional memory is limited to 640 kilobytes.

CPU Central processing unit. This term refers to the computer's main processing chip, the "brain" of the machine. The 486 and Pentium are examples of processor chips, or CPUs.

CRC (Cyclic Redundancy Check) The mathematical calculation performed on a data block to detect any errors.

Current Drive The drive your computer is using right now, displayed at the DOS prompt as C> or A>. *C* is used for the hard drive and *A* stands for the floppy drive. (If your computer has two floppy drives, A represents the primary drive and B represents the secondary one.)

Cursor A short, blinking line that appears underneath the space where the next character is to be typed or deleted. The cursor indicates that the computer is waiting for the user to input a command or other information.

D

Decompression To reverse the procedure conducted by a compression software algorithm, returning data to its original size and condition.

Device Driver The software that a computer system uses to communicate with a device such as a scanner or a mouse.

Dialog Box An on-screen box found in graphical user interfaces such as Windows. Dialog boxes may give you information, explain limited options or allow you to choose settings by checking boxes or highlighting menu items.

Digital Video A video signal represented by computer-readable binary numbers that describes a finite set of colors and luminance levels.

Directory An area of a disk or diskette that stores the names of files and subdirectories. A directory is similar to a table of contents for a book.

Directory Tree A way of organizing data into a hierarchical structure, beginning with a root directory and branching into subdirectories and files.

Diskette A flat piece of flexible plastic covered with a magnetic coating that is used to store data (also called a disk, or a floppy disk). The current standard diskette size is 3.5 inches. Older computers may use 5.25-inch disks.

Dithering Blurred transition from one color to another in a computer picture.

DMA (Direct Memory Access) Memory access that does not use the microprocessor, often used to transfer data directly between memory and a peripheral device such as a hard disk.

DOS DOS stands for disk operating system, software that translates the user's commands and allows application programs to interact with the computer's hardware. DOS supplies a file management system for efficient disk input and output.

DOS Extender A superset of, or addition to, software programs that allows the programs to run in extended memory.

DOS Prompt The signal that DOS is awaiting your command. The prompt is usually displayed as the current drive letter and the greater-than symbol (>). Thus C> is a DOS prompt, with C representing the hard drive.

Download To transfer data from one PC to another. The receiving computer downloads data from the data-sending computer.

Driver A software program that allows the operating system (like DOS or OS/2) to work with a specific hardware device like a printer, a mouse or a trackball.

DVI (Digital Video Interactive) Intel's DVI standard simultaneously displays compressed video images and sound files. IBM has adopted the DVI standard for its Ultimedia product line. Microsoft adds DVI capability through its DVMCI extensions.

Dynamic Data Exchange (DDE) The form of interprocess communication used by Windows to support the exchange of commands and data between two applications running simultaneously.

Dynamic Link Library (DLL) An executable code module for Windows that can be loaded on demand and linked at run time, and then unloaded when the code is no longer needed.

E

Expanded Memory Memory that is available to an application as 16K pages, mapped to a 64K page frame. Expanded memory is usually provided by a device driver, such as EMM386.EXE, or by a memory manager program, such as QEMM or 386MAX.

Expanded Memory Specification A technique for adding memory to PCs to bypass the 640K limit on addressable memory. To use expanded memory, an application must be specifically designed to interact with an expanded memory manager.

Expansion Card Electronic circuit cards that fit into slots on the main circuit board inside the case of the computer. Expansion cards are used to add such items as faxes, modems, sound capability, ports and other add-ons to a PC.

Expansion Slot A socket inside the computer case that is designed to hold expansion cards.

Extended Memory The memory at physical addresses over 1024K, which can be accessed in protected mode on 286 and later CPUs.

Extended Memory Manager A driver, such as HIMEM.SYS, that is necessary to access extended memory.

F

File A collection of data saved under the same name in the computer. The data may be the text in a document, the body of a database, the lines on a chart, or a combination of different types of information.

File Allocation Table A hidden table on a floppy diskette or hard disk that stores information about how files are stored in distinct, but not necessarily contiguous, sectors.

Floppy Disk Drive Floppy disk drives allow computer users to access and store data on a diskette. The two existing standards for floppy disk drive sizes are 5.25-inch and 3.5-inch.

FM Synthesizer A device creating electronically synthesized music. An FM synthesizer combines carrier and modulator waveforms of various types and frequencies to create a new waveform. This new waveform contains the overtones that simulate the sound of a conventional musical instrument.

Font A complete set of characters for one style of a specific typeface, including all the letters, numbers and punctuation marks.

Format To prepare a disk or diskette so it can store information. Formatting organizes the tracks and sectors that store information. Formatting a disk erases any information stored on it.

Fragmentation A problem that occurs when a file's data is not placed in contiguous locations on disk sectors. The file segments are spread across different areas of a disk, which can slow down programs or lead to memory problems.

Frame One image of a motion picture film or one complete occurrence of a video display image (1/30th of a second). Frame-based animation uses the term to define an image statically displayed for a specified period of time.

Frequency Modulation A term describing the interaction of two signals, a carrier and a modulator, in which the modulation signal varies the signal of a carrier. In FM synthesis, a low-frequency oscillator modulates a carrier that is the fundamental frequency of the sound.

Full-Motion Video A name for presenting video images in a window with accompanying sound. On a sufficiently high-speed computer and disk drive, each frame of video comprising the sequence will be displayed and all sound will be heard. Slower computers and data sources (such as CD-ROM drives) drop as many video frames as required when attempting to provide intelligible sound from waveform audio files. Full-motion video files must be compressed, either by hardware or software techniques, to prevent even short video segments from occupying all of the available hard disk space.

Function Key A key that acts as a shortcut for performing certain functions, such as saving or printing data. Function keys are labeled F1 through F10 (or F12) and they run across the top or down of the side of the keyboard.

G

Gain The increase in signalling power as an audio signal is boosted by an electronic device. Gain is measured in decibels.

GIF (Graphic Interchange Format) GIF is a file format (and extension) for storing graphic images.

GM (General MIDI) A specification for consumer melodic and percussion synthesizers developed by MIDI Manufacturers Association. GM defines a group of 96 standard voices and a group of MIDI note assignments representing specific nonmelodic percussion instruments, such as drums.

Grabber Software that supports the exchange of data in video memory between non-Windows applications and Windows 3.0 or higher.

Group A collection of applications in the Program Manager window.

GUI (Graphical User Interface) Pronounced "gooey," GUI is a user-friendly alternative to character-based interfaces such as DOS. GUI applications allow the user to point with a mouse at a list of options instead of having to type a command.

H

Hard Disk A data storage device for personal computers that consists of rigid platters fixed inside a sealed casing. A hard disk can store more information and retrieve data faster than a diskette can.

Hardware Any part of a computer system that can be physically touched. Printers, keyboards, monitors and the computer itself are all hardware.

High Memory Area The first 64K of extended memory.

High Sierra Format A name assigned to the predecessor of ISO standard 9660 defining the table of contents and directory structure of CD-ROMs for computer applications. Microsoft's MSCDEX driver reads the table of content and directory structure and converts the latter to the structure used by DOS. The CD-ROM files can then be treated as if they were located on a conventional hard disk drive.

I

Icon A visual symbol used to represent programs, documents or commands in a GUI. For example, in a DOS interface you might see the filename LETTER.DOS listed in the directory. In a GUI, you'd see a little picture, or icon, representing the same document. Clicking on an icon can perform a function, such as clicking on a scissors icon to cut an area of selected text.

Indeo Intel's compression/decompression algorithm for scalable software-playback video. Intel licenses Indeo technology to companies such as Microsoft, who then integrate it into products such as Microsoft's Video For Windows. Indeo technology can record 8-, 16- or 24-bit sequences and store the sequence as 24-bit for scalability on higher-power PCs.

Input Device A piece of computer hardware that is used to enter and manipulate information on a computer.

Integrated Circuits An arrangement of miniature transistors used for electronic data transmission.

Integrated Software Integrated software programs pack several applications into one package. These packages usually contain scaled-down versions of spreadsheets, word processors and database programs, and include a communications module for linking a PC to a telephone line.

Interrupt A request-for-attention signal sent by either hardware or software to the CPU, causing the CPU to suspend some operations and transfer control to an interrupt controller.

Interrupt Controller Hardware that handles the signals generated by an interrupt request from a device on the I/O bus.

I/O (Input/Output) Communications between two components of a computer.

IRQ (Interrupt ReQuest Line) Hardware lines over which I/O devices, keyboards and disk drives can send interrupts to the CPU.

ISO-9660 The CD-ROM standard for table of contents and file directory entries, originally called High Sierra Format, has been established by the International Standards Organization as the ISO-9660 standard. (See *High Sierra Format.*)

Interleaved A method of containing sound and video information in a single file but in separate hunks, so that digital images and audio signals may be transferred from a file to a computer's memory without the delays incurred by CD-ROM seek operations.

J

JPEG (Joint Photographic Expert Group) High-quality single-picture spatial compression. Uses DCT (discrete cosine transfer) algorithm. Has been adapted to video, but provides no frame compression.

K

KERNEL One of the core dynamic-link libraries that make up Windows.

Key Frame A video frame in which all of the video information is recorded in compressed fashion. If the clip has a lot of motion, you'll get better playback if every frame is a Key Frame. If there is very little motion, such as a narrator, a higher number of Delta Frames will give satisfactory playback. In general, making every third frame a Key Frame is a good choice with the current Indeo algorithm.

Kilobyte (KB) A unit of measurement of computer memory equivalent to 1024 bytes.

M

Megabyte (MB) A unit of measurement of computer memory equivalent to 1,048,576 bytes.

MCI (Media Control Interface) MCI is a high-level application programming interface (API) created by Microsoft for Windows multimedia programming. MCI provides an intermediate layer between windows. The individual function calls included in the MCI API greatly simplify the programming of simple commands such as Play, Stop and Record.

Media Clip A video segment usually interleaved with an audio segment.

Memory An area where your computer stores data. Data can be permanently stored in ROM (Read-Only Memory) or temporarily stored in the computer's RAM (random-access memory). A computer's RAM is emptied when the power is turned off.

Memory Manager A program that increases the amount of RAM by making extended or expanded memory available to the application programs.

Menu A list of choices that appears in menu programs. You select an option by using a mouse or pressing an arrow key to highlight it.

Meta File A type of graphics file used by Windows and other applications. A meta file stores the objects displayed in the form of mathematical descriptions of lines and surfaces. Windows and its applications use a special form of meta file with the extension WMF.

Microprocessor An integrated circuit containing all the central processing functions of a computer; also called a CPU.

MIDI (Musical Instrument Digital Interface) MIDI is a standard protocol (method) for interconnecting electronic musical instruments and controllers, such as keyboards and computers, so they play in synchronization. The basic hardware and protocol is defined by the MIDI Detailed Specification 1.0, published and maintained by the International MIDI Association.

MMM The extension for files created for display using the Multimedia Movie Player.

Modem A piece of computer hardware that allows a computer to communicate with other computers through telephone lines.

Modulation The process of one wave interacting with another to create a third (resultant) waveform.

Motherboard The printed circuit board that is the foundation of a PC system. This board contains the computer's CPU, RAM chips and expansion slots that enable you to add more functions to your PC.

Motion Video Video that appears to show real motion by displaying a sequence of images (frames) rapidly enough that the eyes see the image as a continuously moving picture.

Mouse A device about the size of your palm that you roll around on a flat surface to quickly move the computer's cursor (or pointer). As the mouse moves, it relays signals that move the cursor on the computer screen..

MPC (Multimedia PC) The MPC standard was originated by Microsoft Corporation and Tandy and is now set by the Multimedia Marketing Council (MMC). Computers, multimedia upgrade kits and individual multimedia hardware components, such as audio adapter cards, that meet a set of specifications established by the MMC may be marked with the MPC trademark.

MPEG (Motion Picture Expert Group) Similar to spatial compression of JPEG, but adds frame-to-frame temporal compression. Compaction is typically three times better than video JPEG. Produces VCR-quality video. MPEGII yields broadcast-quality video.

MSCDEX (Microsoft Compact Disc Extensions) MSCDEX is a driver (MSCDEX.EXE) that is loaded as a DOS TSR application, not a Windows DLL. MSCDEX allows CD-ROMs to be accessed through the conventional DOS commands applicable to hard disk and floppy disk drives.

Multimedia The representation of information on a computer using a combination of sound, graphics, animation, text and video.

Multi-Session Photo CDs (See *Photo CD.*)

N

NiCad (Nickel Cadmium) Material used to make rechargeable batteries. NiCad batteries suffer from what is known as "memory effect"—unless fully discharged before being recharged, the battery's recharge will only last as long as the previous charge. This material is also toxic to the environment, and NiCad batteries must be disposed of as toxic waste.

NIMH (Nickel Hydride) Material used to make rechargeable batteries. NIMH batteries deliver more power per pound then NiCad batteries, and they do not suffer from the memory effect that NiCad batteries do. Nickel Hydride is also not as toxic to the environment, and NIMH batteries can be disposed of by more conventional means.

NTSC (National Television Standards Committee) The NTSC establishes standards for television broadcasting in most of the Western Hemisphere, plus Japan and Korea. NTSC television uses 525-line frames and displays 30 full frames per second. Frames consist of two interlaced fields displayed at about 60 per second, corresponding to the U.S. power line frequency of 60 Hz. NTSC video connections of consumer video products use RCA phonograph plugs and jacks. Most Western European countries use the PAL standard, which works with their 50 Hz power line frequency.

O

Online Service A dial-up service that provides news, information and discussion forums for users with modem-equipped computers.

Operating System The master control program that translates the user's commands and allows application programs to interact with the computer's hardware.

P

Package In a compound document, an embedded icon that contains an object, a file or part of a file or a command.

PAL (Phase-Alternative Line System) PAL is the TV transmission standard of Western Europe (except France). PAL displays 625 lines per frame at a rate of 25 frames per second.

Pan The capability of a synthesizer or sound board to alter the volume on the left and right stereo audio channels, creating the illusion that the sound's source is moving..

Passive Matrix Technology used on LCD (Liquid Crystal Display) displays. Passive-matrix displays illuminate a pixel by sending currents down the appropriate row and column, where they intersect as the lighted pixel.

Photo CD A trademark of the Eastman Kodak Company for its technology and CDs that provide copies of photographic color images in a format compatible with CD-I and CD-ROM XA drives. The Photo CD media is rewritable. If the Photo CD has only been written to once, it is called "single-session." Additional images, and ultimately sound, may be added to the special CD media. A special CD-ROM XA player is needed to read additions to a photo CD-ROM. Photo CD-ROMs with added material are "multi-session."

Pipe A portion of memory used to pass data from one process to another. In MS-DOS, the pipe is symbolized by the vertical line (|) character, which is used to separate the first command from the second command.

Pitch Denotes the horizontal size of a fixed-width font in characters per inch.

Pixels An abbreviation for "picture elements." A pixel is the minimum raster display element, represented as a point with a specified color or intensity level. One way to measure picture resolution is by the number of pixels used to create the image—the higher the number, the better the resolution.

PLV (Production-Level Video) Video similar to VHS, but of a higher quality.

Program Group A set of several programs whose icons can be acted on as a single entity in the Windows Program Manager.

Prompt A signal that the computer is awaiting your input or action. This may take the form of a question, an instruction or a flashing cursor.

Pull-Down Menu An expandable menu that displays more options when the menu category is chosen.

Q

QuickTime Apple Computer's video environment (like Microsoft's Video For Windows). QuickTime video files must be converted to AVI format to run under Microsoft's Video For Windows. Indeo video is supported under MacOS.

R

RAM (Random-Access Memory) This is also referred to as a computer's dynamic or volatile memory, in that data is stored in RAM only temporarily. A computer's RAM storage space is emptied when the power is turned off.

Raster Fonts A set of characters for screen display or printing that are stored as bitmaps in specific character sizes.

Real-Time In computing, refers to an operating mode under which data is received, processed and the results returned so quickly as to seem instantaneous.

Red Book Audio The audio storage and CD-ROM output specification defined in Phillips N.V.'s red-bound book and incorporated in the Windows Multimedia extensions as the standard for CD-ROM audio processing. (See *CD-DA*.)

Registration Database The REG.DAT file, which provides the information used by the Windows File Manager and Print Manager to support drag-and-drop and other actions, and which is used by OLE applications to find file types and OLE capabilities for embedded objects.

Resolution The number of pixels per unit. A display with a finer grid contains more pixels and has a higher resolution, and is capable of reproducing more detail in an image.

RGB (Red-Green-Blue) A type of computer display output signal comprised of separately controllable red, green and blue signals. The other technique for output display is composite video, which typically offers less resolution than RGB.

RLE (Run-Length Encoding) Microsoft's video compression algorithm for base-level multimedia PCs. Compresses 8-bit sequences only. Playback is also in 8-bit and is not scalable for higher-power PCs.

Rock Ridge Format A proposed standard for CD-WO (write-once CDs) to provide directory structure that may be updated as additional files are added.(Files can be added to *unused* segments on the CD at a later time, but not to previously written areas.) The Rock Ridge directory format is used for multiple-session Photo CDs.

Root Directory The main directory of a diskette or hard disk drive.

RTV (Real-Time Video) Single-step compression of video.

S

Sample A digital representation of a sound created with a microphone, an amplifier and an analog-to-digital converter.

Sampling Rate The recording speed of a sound's successive digital samples. The sampling rate is another measure of a digital sound sample's resolution. Standard rates are 11.025, 22.05 and 44.1 KHz. The potential reproduction fidelity of a sample improves with an increase in the sampling rate or frequency, but storage requirements also increase.

Scalable Video With respect to Indeo video, scalable video is a playback format that can determine the playback capabilities of the computer on which it is playing. This format allows video playback to take advantage of high-performance computer capabilities while retaining the ability to play on a lower-performance computer.

SECAM Video format used in France, Eastern Europe, and other places.

SECAM Format 625 lines of resolution at 25 frames per second.

Sequencer A device or application that records and plays back musical compositions in MIDI message format. Computer-based sequencer

applications enable MIDI scores to be composed and edited. Sequencers are often incorporated within the high-end keyboard synthesizers. Stand-alone sequencers are also available. They can record a performance from a MIDI keyboard and then be transported to a computer site and played into a sequencing application for editing.

Shadow ROM A process used to map ROM BIOS activities into faster RAM memory.

Shareware Software distributed free (or at a low cost), often online. Limited usage is allowed, after which you must pay for the program if you decide to continue using it. Shareware distribution permits you to have a trial period using software before purchasing it. Because distribution costs are low, shareware is often much cheaper than commercial software packages.

Software A general term for all types of programs used to manage a computer's operations. Software is essentially a set of instructions the computer uses to perform a task.

Sound Card A peripheral board inserted into a PC expansion slot to enhance audio sounds (and possibly add recording functions).

Subchannel In audio CDs and CD-ROMs, digital information that is not part of the primary data (such as digitized sound or text data) stored on the CD. Subchannel data includes a table of content (a track list), product codes and ownership (copyright) data. Subchannels can be used to store other information such as MIDI files (CD+MIDI) and graphics (CD+G).

Subdirectory A directory located within another directory(called the parent directory). The root directory is the only directory that is not also a subdirectory.

S-VIDEO (Super Video) S-video is a video signal with enhanced quality, used for recording. S-video separates the chrominance signal from the luminance signals of composite video. It uses 4-pin DIN connectors for video I/O.

Sync An abbreviation for the portion of video signals used to synchronize the horizontal and vertical scans.

Synchronization In synthesized sound, the process of controlling multiple sound sources and recording devices, so the time of the occurrence of a sound or image (frame) can be precisely determined.

Syncopation A musical term describing a rhythm in which specific notes precede or trail the beat. Syncopation is one of the characteristics that define jazz music.

Synthesizer An electronic musical instrument that, by making complex waveforms, creates sounds simulating conventional musical instruments as well as other unconventional sounds. Synthesizers usually have built-in keyboards.

T

Task List A Windows dialog box that appears when you press the Ctrl and Esc keys at the same time. The Task List displays active programs running in Windows.

TIFF (Tagged Image File Format) A bitmap file format for describing and storing color and grayscale images.

Transparent Application Integration The ability to manipulate information from a variety of applications within a single document, without moving from one application to another to produce the desired results. This capability is implemented as object linking and embedding (OLE) in Windows 3.1.

TSR (Terminate and Stay Resident) A program that remains in memory after it has been executed. Thus it can be executed without the computer's having to access the drive it is stored on.

U

Upper Memory Area The part of physical memory that starts at 640K and ends at 1024K, addresses A000 through FFFF.

Upper Memory Blocks The parts of the upper memory area that are not used by hardware devices, such as the video ROM.

V

VGA (Video Graphics Array) Standard IBM PC video display. Provides medium-resolution text and graphics. VGA pixel resolution is 640 × 480.

VIDCAP Microsoft's Video For Windows program to capture video input to RAM or hard disk memory.

Video Card A peripheral card or chipset on a PC motherboard that works with the PC to display images on a computer monitor.

VIDEO1 The default video compression algorithm in Microsoft's Video For Windows. Can produce 8- or 16-bit video sequences.

Virtual Device A device that software can refer to but that does not physically exist.

Virtual DMA (Direct Memory Access)Services A specification defining a driver that allows a bus-mastering device to find the real physical address of its data when the processor is in Virtual 8086 mode, such as when running Windows in 386 enhanced mode.

Virtual Hard Drive Memory Factor The available space on a hard drive partition that Windows can address as physical memory.

Virtual Machine Software that mimics the performance of a hardware device.

Virtual Memory A technique of simulating additional memory for an application to use. Applications access the memory through virtual addresses, which are mapped onto physical addresses on the disk.

Virtual Memory Manager (VMM) The facility in Windows 386 enhanced mode that manages the task of swapping data in and out of virtual memory for multiple non-Windows applications running virtual machines. The Windows VMM can manage paging in up to 48 MB of virtual memory.

VL-Bus (VESA Local Bus) A bus standard for PCs developed by the Video Electronics Standards Association to allow faster data access for high-resolution graphic displays.

W

Wave File A RIFF (resource interchange file format) file containing PCM waveform audio data. The file usually has a WAV extension.

Waveform Audio A data standard of the Windows Multimedia Extensions. Waveform audio defines how digitally sampled sounds are stored in files and processed by Windows API functions.

Windows A graphical user interface (GUI) environment program that allows application program launching and multitasking. Windows software comes with most PCs sold today.

Windows API The API for Windows helps applications manage windows, menus, icons and other GUI elements.

Word Processor An application program for writing, editing and printing text files.

WORM (Write-Once, Read-Many) WORM is the original description of a writeable CD-ROM that may be prepared in a special optical disk drive. CD-WO is a special type of WORM format.

X

XMM (Extended Memory Manager) See *Extended Memory Manager.*

XMS (Extended Memory Specification) See *Extended Memory.*

References

Computer Industry Names and Phone Numbers

Company	Contact Number
3Com Corp.	(408) 764-5532 (800) 876-3266 technical support
A.B. Dick Company	(312) 763-1900
Ac Bel Technologies	(408) 452-7811 technical support
ACS/KRIS Technologies	(800) 282-5747
Access Software	(801) 359-2900
Acclaim Entertainment Inc.	(516) 624-8888
Accolade Inc.	(408) 985-1700
Acer America Corp	(408) 922-2953
Acer Technologies	(800) 637-7000
Acknowledge Inc.	(800) 533-1776
ACMA Computers Inc.	(510) 623-0818
Activision/Infocom	(310) 207-4500 (310) 207-4500 BBS
A.D.A.M. Software	(800) 755-ADAM

Company	Contact Number
Adaptec	(800) 959-7274 technical support (408) 945-7727 BBS
Aditus	(514) 737-8547
Adlib Accessories	(800) 260-2603
Adlib Multimedia	(418) 656-8742
Adobe Systems Inc.	(408) 986-6530 PC and compatibles technical support
Advanced Computer Innovations	(716) 383-1939
Advanced Software, Inc.	(408) 733-0745
Adv Digital Info. Corp	(206) 881-8004
Adv Logic Research Inc. (ALR)	(714) 581-6770
Adv Technologies	(408) 748-1688
AfroLink Software	(305) 423-4289

Aldus phone directory	(206) 628-2040 Support phone directory
All Comp. Inc.	(416) 960-0111 All-card multifunction board
Allegro New Media	(210) 808-1992
Alliance Interactive	(305) 423-4289
Alloy Computer Products	(508) 481-8500
Alpha Data Inc.	(818) 882-6500
Alpha Software Corp.	(617) 272-3680
Alps America	(800) 825-2577
Altec Technology Corp.	(800) 255-9971
Altos	(408) 745-6751
Amax Engineering Corp.	(510) 651-4119
Amaze! Software	(206) 820-4102
Ambra Computer Corp.	(800) 252-6272
Amdek Corp.	(408) 435-2770 customer service, technical support
American Computer Research	(408) 257-8998
American Laser Games	(505) 880-1718
American Megatrends, Inc.	(404) 263-8181 AMI technical support
American Micronics	(510) 651-2300
American Mitac Corp.	(800) 648-2287
Ampro Comp. Inc.	(408) 734-2800
AMS Inc.	(818) 814-0782
Andromeda Interactive	(510) 769-1616
Animatics	(613) 241-7200
Answer Software Corp.	(408) 253-7515
AOX Inc.	(617) 890-4402
Apogee Software Productions	(704) 525-7996
Apparat Inc.,	(303) 799-0819
Apple Computer, Inc.	(408) 996-1010
Apple Corp.	(800) 776-2775 (800) 776-2333 technical support: Application Network
Applied Images	(408) 251-4006
Applied Optical Media Corp.	(215) 429-3701
Applied Reasoning Corp.	(617) 492-0700
Apogee Software	(800) 426-3123
APT	(800) 448-1184
Archive Corp.	(714) 641-0279
ARES Microdevelopment Inc.	(810) 473-4450
Aris Multimedia Entertainment	(310) 821-0234
Aristo Comp. Inc.	(800) 3-ARISTO
Artisoft	(602) 670-7000
Asher Technologies	(404) 564-2353
Ashton-Tate	(408) 431-9060 technical support
Ask Me Multimedia	(800) 531-0603
Aspen Computer Inc.	(800) 472-3273
Associates Mega Subsystems	(818) 814-8851
AST Research Inc.	(714) 727-4141 main number (800) 727-1278 technical support
Asymetrix	(206) 637-1600
Atari	(408) 745-2014

AT&T (ATT)	(800) 543-9935 technical support
ATI Technologies Inc.	(905) 882-2626 (905) 764-9404 BBS
Atron	(408) 253-5933
Attachmate	(206) 644-4010
Austin Computer	(800) 752-4171 technical support
Autodesk	(415) 332-2344
Autodesk Retail Prod.	(800) 228-3601
AutoMap	(602) 893-2400 technical support
Automated Time Equip. Corp.	(615) 377-1156
Asymetrix	(206) 637-1600
Award Software	(415) 968-4433
Axonix Corp.	(801) 466-9797
Aydin Corp.	(215) 628-4372
Aztec Labs, Inc	(905) 746-9404
Banyan Systems	(508) 898-1000 (508) 836-1834 Online access
Basic Time	(408) 727-0877
Bayware, Inc.	(415) 312-0980
BEC Computer	(714) 594-8779
Bell Technologies	(415) 659-9097
Berkeley Systems	(510) 540-5535
Better Software Bureau	(201) 460-0677
Big Top Productions	(800) 900-7522
Bi-Tech Enterprises Inc.	(800) 645-1165
Bitstream Inc.	(617) 497-7514 technical support
Blaser Industries	(800) 322-3399
Blue Chip Electronics Inc.	(602) 431-3960
Blue Sky Software	(800) 677-4WIN
Boca Research	(407) 997-6227
Books That Work	(800) 242-4546
Borland Intl.	(800) 841-8180
BrainWorks	(800) 999-9989
Bright Star Technology	(800) 757-7707
Britannia Software	(800) 533-0130
Broderbund Software	(415) 382-4700 technical support (415) 883-5889 BBS
Brother Intl. Inc	(800) 284-4357 technical support
Bungie Software	(312) 563-6200
Bureau Of Electronic Publishing	(210) 808-2700
Burrell Business Systems	(219) 663-3210
BUS Computer Systems Inc.	(212) 627-9872
Business Comp. Inc.	(918) 825-4844
Business Computer Services	(213) 837-1028
Byte Magazine	(603) 924-9281 main office
CAD/CAM Group Inc.	(408) 356-2939
Caere Corporation	(800) 462-2373 technical support
Calcomp	(800) 458-5888
Cambridge Scientific Computing	(617) 491-6862
Cambrix Publishing	(818) 992-8484

Candlelight Publishing	(800) 677-3045
Canon	(800) 432-1467 (800) 652-2666 technical support
Capstone	(800) 468-7226
Cardinal Technologies	(717) 293-3000 (717) 293-3124 technical support
Cayman Systems, Inc.	(617) 494-1999
CCT Inc.	(201) 370-5000
CD-ROMIX	(800) 545-7677
CD-Technology	(408) 752-8500
Celebrity	(214) 239-6085
Central Point Software	(503) 690-8080 technical support
Centram Systems West	(415) 769-8711 technical support
Century Data Inc.	(408) 298-5756
Certus	(216) 546-1050 technical support
CFN Industries	(415) 443-1672
Chaplet System	(408) 732-7950 technical support
Cheetah Intl. Inc.	(800) 243-3824
Chinon //america	(800) 441-0222
Chips & Technologies	(408) 434-0600
CIE Terminals	(714) 660-1421
Cipher Data Products	(619) 578-9100
Cirrus Logic, Inc.	(510) 623-8300 (510) 440-9080 BBS
Citizen America Corp.	(310) 453-6649
Claris Co.	(408) 727-9054 general technical support
Clearpoint Inc.	(800) CLE-ARPT
CLEO Software	(800) 233-2536
Club AT Inc.	(510) 490-2201
CMS Inc.	(714) 222-6000
CMS Research	(503) 241-4351
Cobb Group	(502) 491-1900 (800) 223-8720
Colorado Memory Systems	(303) 669-8000 (303) 635-1500 technical support
Commodore Business	(800) 448-9987 technical support
Communication Machinery Corp.	(800) CMC-8023
Compact Publishing	(202) 244-4770
COMPAQ Computer Corp.	(800) 652-6672 technical support
CompCare	(800) 382-8324 support for CompUSA Compudyne computers
Complete Electronics Inc.	(714) 458-0130
Compton's NewMedia	(619) 929-2500
CompuAdd Computers	(512) 250-1489
CompuSource Inc.	(800) 445-0123
Computer Assoc.	(408) 432-1764
Computer Elektronik Information Systems	(703) 435-3800
Computer Mail Order (CMO)	(800) 233-8950
Computer Mail Service	(313) 559-3266
Computer Peripherals Inc.	(805) 499-5751 (800) 235-7618 technical support

Computer Specialist	(215) 288-0047
Computer Support Corp.	(214) 661-8960
Computer Virus Industry Association (CVIA)	(408) 988-3832 McAfee Associates
Conner Peripherals	(800) 426-6637 (800) 526-6637 hard drive support & sales
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Conrac Corp.	(818) 966-3511
Consolink Corp.	(303) 651-2014
Consumer Software Inc.	(604) 688-4548
ContRiver Technology Inc.	(818) 810-2705
Control-C Software	(503) 641-8128
Copal USA Inc.	(800) 441-7263
Corel Corporation	(613) 728-8200 (613) 728-1990 CorelDRAW! tech support; (613) 761-9175 fax line for support questions
Cornerstone Technology	(800) 562-2552
Corvus Product Support	(408) 946-7700
Cosmo World Corp.	(800) 227-3378
Covox technical	(503) 342-1271 (503) 342-4135 BBS
Creative Labs	(405) 742-6660 technical support BBS (1200/2400 baud access) (405) 742-6662 or (405) 742-6664 BBS (9600/14,400 baud access)
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Creative Multimedia	(503) 241-4351
Crescent Software	(203) 438-5300
Cricket Software	(215) 251-9890
CSS Laboratories	(714) 852-8161
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Data General Data Pac	(800) 327-6703
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Data Zone Inc.	(818) 704-4955
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Dayna Communications	(801) 531-0600
Deep River Publishing	(207) 871-1684
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Deneba Software	(305) 596-5644
Denon America	(201) 575-7810
Destiny Technology Corp.	(408) 733-3171
Diablo Systems Inc.	(415) 786-5000

DiagSoft	(408) 438-8247
Diamond Computer	(408) 736-2000 (408) 730-1100 BBS
Digiboard	(800) 344-4273
DigiData Corp.	(310) 498-0200
Digital Communications Associates (DCA)	(404) 740-0300
Digital Equip. Corp.	(800) 354-9000 (508) 496-8800 BBS technical support
Digital Research Inc.	(800) 638-9273
Digital Storage Systems Inc.	(303) 449-9684
Digitalk Inc.	(800) 922-8255
Discount Micro Products Inc.	(313) 477-2793
Discovery Systems	(614) 761-2000
Discus Knowledge Research	(416) 250-6537
DK Multimedia	(800) 356-6575
Dolen Computer Corp.	(203) 844-0895
Dorling Kindersley Multimedia	(800) 225-3362
DoMark	(800) 695-4263
Dr. T's Music Software	(617) 455-1454
Drew Pictures	(415) 247-7600
DTK (Datatech)	(818) 810-0098
Dynamic Dimensions	(817) 336-1105
Dynamic Graphics Inc.	(309) 688-8800
Dynamix	(800) 757-7707
Eagle Comp.	(215) 388-1515
Eastman Kodak Company	(800) 44-KODAK
Ebook	(510) 429-1331
Eccentric Software	(800) 436-6758
Edmark	(800) 691-2985
Eduquest (IBM)	(800) 426-4338
EFS Management Software Inc.	(415) 598-9090
Eidolon	(718) 884-7095
Eikon Systems	(415) 349-4664
ELAN Software Products Inc.	(408) 288-6831
Electrohome Limited	(519) 744-7111
Electronic Arts	(415) 571-7171
Electrotek Concepts Inc.	(412) 746-4460
Emerald Entertainment	(714) 494-4988
Emerson Computer Company	(800) 677-3226
Emerson	(213) 722-9800
Emulex/Persyst Division	(714) 662-5600
Epelo	(702) 883-8008
Epsilon Graphics Corp.	(714) 558-1288
Epson America	(800) 922-8911 technical support
Everex Systems	(800) 821-0806
Everex comp.	(510) 498-1115 technical support
Evolution Computing	(602) 967-8633
Excelan Inc.	(800) EXCELAN
Executive Systems	(800) 964-2490
Exis Telex Communications	(416) 289-4641
Expert Software	(305) 445-6304
Extended Systems	(208) 322-7163
Facit Inc.	(603) 424-8000
Farallon Computing Inc.	(510) 814-5000 (510) 865-1321 BBS technical support

Fast Technology	(800) 279-0889 technical support
Fathom Pictures	(415) 289-2500
Fifth Generation Sys.	(504) 291-7283 technical support
FileNet	(714) 966-3400
First Aid Software	(617) 783-7118
Florida Data Corp.	(305) 259-4700
Focam Technologies	(514) 687-4883
Foresight Resources Corp.	(800) 231-8574 (816) 891-1040
Fortis Info. Systems Inc.	(800) 241-1227
Fortron Corp.	(408) 432-1191
Fox Software	(419) 874-0162
Franklin Telecom	(805) 373-8688
The FreeSoft Company	(412) 846-2700
Front Line Systems	(702) 831-0300
FTG Data Systems	(714) 995-3900
Fujitsu America	(408) 432-6333
Funk Software, Inc.	(617) 497-6339
Fusion Digital Media	(800) 996-0011
Future Domain	(714) 253-0400 sales and technical support
Future Soft Engineering Inc.	(713) 496-9400
Future Tech Systems Inc.	(206) 939-7552
Future Vision Multimedia	(800) 472-8777
Galacticomm	(305) 583-5990
GameTek	(305) 935-3995
Gateway Communications Inc.	(800) 367-6555
Gateway 2000	(800) 846-2301 technical support
Gazelle Technologies (Educorp)	(619) 693-4030
GEMart Digital Research	(800) 443-4200
Generic Software	(206) 487-2233
Genicom Corp.	(800) 443-6426 (703) 949-1031 technical support
Genoa Systems Corp.	(408) 432-9090
GEOVISION Inc.	(404) 448-8224
GoldStar Electronics	(800) 777-1192
Graphic Software Systems Inc.	(503) 641-2200
Great Bear Technology	(800) 795-4325
Great Plains Software	(701) 281-0550
Grolier Electronic Publishing	(800) 285-4534
GT Interactive Software	(800) 332-4300
GTCO Corp.	(301) 381-6688
Hammerlab Corp.	(203) 624-0000
Hayes Microcomputer Products	(404) 441-1617 technical support
Headland Technologies, Inc.	(408) 433-8000
Hercules Computer Technology	(415) 540-0749 Technical support
HES	(415) 468-1111
Hewlett-Packard (HP)	(800) 752-0900 Ccentral technical support number
Hyperglot Software Co.	(615) 558-8270
IBM Multimedia Publishing Studio	(800) 898-VTGA
IBM Technical support	(800) 992-4777
I C F X	(415) 485-5850
Id Software	(800) 434-2637

IMSA Inc.	(800) 222-4723
Individual Software Inc.	(510) 734-6767
InfoBusiness, Inc.	(510) 221-1100
Intel Corp.	(800) 538-3373 (303) 678-2222 BBS
Intellimedia	(800) 269-2101
InterActive Publishing Corp.	(914) 426-0400
Interplay	(800) 696-4263
Interplay Productions	(714) 553-6655
ION	(310) 312-8060
IVI Publishing	(612) 686-2600
JAmBone Comics	(604) 739-7281
Jasmine Multimedia Publishing	(818) 780-3344
Journeyware Media	(510) 284-2619
KYE International	(714) 923-2417
Knowledge Adventure	(818) 872-7487
Knowledge Media	(916) 872-7487
Landis & Gyr Powers	(312) 272-9555
Laser Master	(612) 944-9331 technical support (612) 944-9330 Sales
Laser Resources	(310) 324-4444
Lasertools Corp.	(800) 767-8005 technical support
Leading Edge Products Inc.	(800) 874-3340
The Learning Company	(510) 792-2101 (510) 792-9628
Legalware Inc.	(416) 863-6906
Legend Entertainment Co.	(800) 658-8891
Lexmark (& IBM)	(606) 232-3000 (606) 232 5653 BBS
Lifeboat Associates	(212) 860-0300
Lightpen Company	(213) 305-7616
Linotype Company	(516) 434-2000 (800) 633-1900 technical support
Lintronic Software Publishing	(703) 552-7204
Live Entertainment	(800) 326-1977
Living Books	(800) 521-6263
LocalNet Communications Inc.	(714) 549-7942
Logitech	(510) 795-0427 (510) 795-8500 technical support
Lotus Development	(617) 253-9150 technical support
LucasArts Entertainment	(415) 721-3300
Lumaria	(415) 821-0536
Lunar Eclipse Software	(703) 759-0700
Macmillan New Media	(617) 661-2955
Macromedia	(800) 326-2128
Magitronic Technology Inc.	(516) 454-8220
Magna Computer Corp.	(603) 622-3699
Magnet Interactive	(202) 625-1111
Magnetic Peripherals	(612) 853-8100
MainLAN	(800) 999-6770 technical Support
Manhattan Graphics	(914) 769-2800
Mannesmann Tally	(206) 251-5500
Manx Software Systems	(800) 221-0440
MapInfo Corp	(518) 285-6000

Mass Micro	(800) 442-7979 technical support (800) 522-7979 customer service
Mastersoft Inc.	(800) 624-6107
MathSoft Inc.	(800) 628-4223
Matrix	(800) 365-0191 (914) 365-0190 main number
Max Group	(818) 968-6798
Maxis	(800) 336-2947
Maxtor	(800) 356-5333 (800) 262-9867 technical support
Maynard Electronics	(305) 331-6402
McAfee Associates	(408) 988-3832 (408) 988-4004 BBS
MCAE (Modern Computer Aided Engineering)	(317) 497-1550
McGraw-Hill	(212) 337-5961
MECA Software Inc.	(203) 256-5159
MECC	(612) 569-1500
Media Vision	(510) 770-9905 (800) 638-2807
Mediatrix Peripherals	(800) 820-8749
Media Cybernetics	(301) 495-3305
Medio Multimedia	(206) 867-5500
Megamedia Computer	(800) 634-2633
Meridian Data	(408) 476-5858 distributor of CD-ROM extensions for Hitachi CDR-1502S, CDR-2500S, Philips CM-100, Sony CDU-100
Merit Software	(800) 238-4277
Meta Software Corp.	(617) 576-6920
Metheus Corp.	(503) 640-8000
Metz Software	(206) 869-6292 technical support
M/H Group Inc.	(312) 443-1222
Micom-Interlan Inc.	(617) 263-9929
MicroSolutions	(815) 756-3411
Microsystems Inc.	(213) 306-7412
Micro Decisionware	(303) 443-2706
Micro Display Systems Inc.	(612) 437-2233
Micro Express	(714) 852-1400
Micro Peripherals	(619) 487-7112
Micro Smart Inc.	(617) 872-9090
Micro Tempus	(514) 397-9512
Micro-Computer Education	(213) 316-0136
Micro-Design Intl.	(305) 677-8333
Microcom	(617) 551-1414 (919) 551-1277
Microfield Graphics Inc.	(617) 576-6920
MicroFirmWare	(405) 321-8333 technical support for Phoenix BIOS
Micrografx Inc.	(214) 234-1769 (214) 234-2694 technical support
MicroLogic	(510) 652-5464
Microlytics, Inc.	(716) 248-9620
Micromint	(800) 635-3355
Micron Technology Inc.	(208) 383-4000
Micronics Comp.	(510) 651-2300
Micropolis Corp.	(818) 709-3300
Microprose	(800) 879-7529

Microscience Intl.	(408) 433-9898
Microspeed Inc.	(415) 490-1403
Microsoft Product Support Services	(800) 227-4679
Microsoft Download	(206) 936-6735 BBS Service
Microtech International Inc.	(203) 488-7744
Microtek Lab Inc.	(213) 321-2121
MicroTRENDS tools	(312) 310-8928
Micro Vitech Inc.	(404) 991-2246
MicroWay Inc.	(508) 746-7341
MicroWorkshop Inc.	(516) 737-5600
Midisoft	(800) 776-6434
Millikin Publishing Co.	(800) 325-4136
Miniscribe	(303) 651-6000
Mitsubishi Electronics America Inc.	(714) 220-2500
Mitsubishi Electronics	(800) 344-6352 technical support
Mitsumi Electronics	(800) 648-7864
Monitor Technology	(612) 551-1478
Monitronix Corp.	(614) 891-3232
Monolithic Systems Corp.	(800) 525-7661 (303) 790-7400
Moon Valley Software	(602) 375-9502 technical support
Motorola	(800) 441-2447
Mountain Computer Inc.	(800) 458-0300
Mountain Network Solutions	(408) 438-7897 (408) 438-2665 BBS
MP&G Research Inc.	(312) 297-4609
MPI Multimedia Inc.	(708) 535-1540
MSC Technologies	(510) 656-1117
Multicom Publishing	(206) 622-5530
Multiwave Innovation	(408) 379-2900
Mylex Corp.	(800) 776-9539
N/Hance	(617) 461-1970
Nanao Corp. of America	(213) 325-5202
Nantucket	(310) 390-7923
National Geographic (CD-ROM Software)	(800) 342-4460
National Geographic Society	(800) 368-2728
National Memory Systems Inc.	(415) 443-1669
NEC	(708) 860-0335 technical support (508) 635-4706 BBS
NEC Home Electronics	(800) 366-3632 CD ROM support
Network PC	(800) 87EXCEL
NetWorth Inc.	(800) 544-5255
Neuron Data	(415) 321-4488
New Machine Publishing	(310) 453-5068
New Media Schoolhouse	(800) 672-6002
Newer Technology	(316) 685-4904
Newquest	(801) 975-9999
NISCA, Inc.	(214) 242-9696
Nissei Sangyo America	(312) 981-8989 distributor of CD-ROM extensions for Hitachi CDR-1502S, CDR-2500S, CDR-2500, CDR-1503S
Nissho Info. Systems Corp.	(800) 952-1919
Nixdorf computer Corp.	(607) 890-3600
Normerel U.S.	(800) 327-9877 ATC 12 computer

North Atlantic Industries	(516) 582-6060
Northgate Computer Systems	(800) 446-5037 domestic technical support
Norton	(310) 319-2000
NovaLogic Inc.	(818) 774-0600
Novell Development Div.	(800) 733-9673 Presale technical information
Novell Hardware Products Division	(408) 729-6700
Novell Netware	(800) 638-9273 technical support for Netware
Novell Technical Support	(800) 638-9273
NTI Group	(408) 739-2180
Number Nine Corp.	(617) 492-0999
Oak Technologies	(408) 737-0888 technical support (408) 524-9014 BBS
Oasis	(619) 222-1153
Oasis Office Automation Systems	(619) 576-9500
Objective Systems	(415) 929-0964
Ocean Information Systems	(800) 325-2496
OCR Systems, Inc.	(215) 938-7460 main number (technical support)
Octave Systems Inc.	(408) 866-8424
Okidata Printers	(800) OKI-DATA
Olicom	(214) 423-7560
Olivetti	(908) 526-8200
Olympia USA Inc.	(800) 832-4727.
OMNIDATA	(800) 634-6664
Online Computer Systems	(301) 428-3700 distributor of CD-ROM extensions for Hitachi CDR-1502S, CDR-2500S, CDR-2500, CDR-1503S
OnLine Store	(805) 650-0188
OnTrack Software	(612) 937-2121 technical support
Opcode Interactive	(415) 494-1112
Open Books Inc.	(617) 547-9600
Optical Data Interactive	(800) 887-0022
Optical Recording Corp.	(416) 596-6862
Optigraphics Corp.	(619) 292-6060
Oracle Corp.	(800) ORACLE1
Orchid Technology	(510) 683-0323 Orchid Designer VGA graphics board
Orchid Technology	(510) 683-0555 9600-baud BBS (510) 683-0327 2400-baud BBS
Origin Software	(800) 245-4525
Origin Systems	(512) 335-5200
Osborne/McGraw-Hill	(800) 227-0900
Output Technology Corp.	(509) 926-3855
Output Technology Corp.	(800) 422-0485
Ovonic Imaging Systems	(800) 451-7566
P.S.I. Technologies	(800) 833-2998
Pacific Data Products	(619) 587-4690 sales and technical support
Pacific Rim Systems Inc.	(510) 782-1013

Packard-Bell	(800) 733-4411 technical support
Palindrome Corp.	(800) 288-4912
Panasonic	(800) 222-0584 technical support
Paradise	(800) 832-4778
Paradise Systems Inc.	(415) 960-3353
Paramount Interactive	(415) 812-8200
Parsons Technology Inc.	(800) 233-6925
Paul Mace Software	(800) 523-0258
PC Direct	(415) 974-5133
PC Source (subsidiary of CompuAdd)	(800) 531-5475
PC Technologies Inc.	(800) 821-3086
PC's Limited	(512) 339-6800
PCW Communications	(415) 546-7722
Peachtree Software	(404) 923-4318 technical support
Percept	(617) 893-6390
Peripheral Marketing, Inc.	(602) 483-7983
Peripheral Technology Inc.	(806) 581-1000
Peripherals Plus	(415) 459-1000
Periscope Company Inc.	(404) 875-8080
Personal Computer Graphics	(213) 216-0055
Personal MicroComp. Inc.	(408) 737-8444
Phillips Info. Systems Inc.	(214) 980-2000
Phillips Interactive Media	(800) 976-GAME
Phillips Product Support Center	(800) 722-6224
Phillips (Vendex) Technical Support	(900) 454-5554 Vendex support
Phoenix Technology	(617) 551-4000 main number (support, administration)
Pinnacle Publishing	(206) 383-4396
Pinpoint Publishing	(415) 654-0287 technical support
Pioneer New Media Technologies	(800) 444-6784
Pixis Interactive	(714) 669-1818
PKware Inc.	(414) 352-3670 information (414) 354-8670 BBS
Playroom Software	(704) 536-3093
Polaris Software	(619) 674-6500
Pop Rocket	(415) 731-9112
Power Up Software	(415) 345-0551
Presentation Technologies	(408) 749-1959 (800) 345-7050
Presto Studios	(619) 689-4895
Priam Corp.	(408) 434-9300
Primages Inc.	(516) 585-8200
Primavera	(215) 667-8600
Princeton Graphics Systems	(609) 683-1660
Princeton Publishing Labs	(609) 924-1153
Printek Inc.	(800) 368-4636
Printronix Inc.	(800) 826-3874
Priority One Electronics	(800) 423-5922
ProComm	(714) 549-9449 technical support
Prodigy Services	(800) 284-5933 technical support
Profit Systems Inc.	(313) 647-5010
Prolink Computer	(213) 780-7978

Promise Technology	(408) 452-1534 sales (408) 452-1180 technical support
Proteon	(508)-898-3100 technical support
Proteus Comp	(800) 782-8387
PS Publishing Inc.	(415) 433-4698
Psygnosis Ltd.	(617) 497-7794
Pure Data Limited	(214) 242-2040
Putman New Media (MCA)	(703) 860-3375
QDP Computer System	(216) 464-6600
QIC Research Inc.	(408) 432-8880
QMS Inc.	(205) 633-4300
Quadram Corp.	(404) 923-6666 UltraVGA graphics adapter
Quadrant Computers	(510) 656-9988 computers
Quadtel Systems	(714) 440-8000 BIOS technical support
Quality Micro Systems	(205) 633-4300
Qualstar Corp.	(818) 882-5822
Quant Systems	(803) 571-2825
Quantum Commercial	(800) 624-5545
Quantum	(800) 826-8022 technical support (408) 894-3214 BBS
Quantum Leap Technologies	(800) 762-2877
Quark Inc.	(303) 934-2211 main number (mfg. QuarkXpress) (800) 356-9363 dealer number
Qualitas	(301) 907-6700 386MAX
Quarterdeck Office Systems	(310) 392-9851 QEMM
Queue	(800) 232-2224
Quimax Systems Inc.	(800) 228-0530
Qumax Corp.	(408) 954-8040
Qume Corp.	(408) 942-4100 (408) 942-4219
R Company	(213) 393-9992
Racet Comp. Limited	(714) 579-1725
Radius, Inc.	(408) 434-1010 (408) 434-1012 technical support
RasterOps	(801) 221-1129 BBS
Reactor	(312) 573-0800
ReadySoft	(905) 731-4175
RealWorld Corp.	(800) 678-6336
Reference Software	(415) 541-0222 main number
Reference Technology	(303) 449-4157 distributor of CD-ROM extensions for Hitachi CDR-1502S, Philips CM-100, Sony CDU-100
Relisys	(408) 945-1062
Retix	(213) 399-2200
Reuters Info. Services	(212) 603-3580
Reveal Computers	(800) 4REVEAL
Ricoh Corp.	(800) 227-4264 technical support
Rix SoftWorks Inc.	(800) 345-9059
Rocket Science Games Inc.	(415) 328-8181

Roland	(213) 685-5141 technical support/ customer service
Rose Hill Systems	(800) 248-ROSE
Rosesoft	(206) 562-0225
RoundBook Publishing	(408) 438-4222
(RSI)	(415) 563-9175 OPUS
Saber Software Systems	(214) 361-8086 technical support
Sales Curve	(310) 577-1515
Samna Corp.	(404) 256-2272
Samsung Information Systems America, Inc.	(800) 446-0262 (800) 624-8999 technical support
S.F. Micro	(415) 751-7781 Creative Edge hard disk
Santa Cruz Operation	(800) 347-4381 technical support
Sanyo	(201) 440-9300
Sapiens Software Corp.	(408) 458-1990 Windows V64 virtual memory manager
Scada Logic Inc.	(201) 381-6727
Scientific Micro Systems	(415) 964-5700
Scion Corp.	(703) 476-6100
Seagate Corp.	(408) 438-8222 technical support
Seattle Telecom & Data Inc.	(206) 883-8440
Sega Of America	(415) 508-2800
Seikosha America Inc.	(201) 327-7227 general technical information
ServiceLink Systems Inc.	(408) 732-1740
7th Level	(214) 437-4858
Shareware to Go	(407) 579-5159
Shiva	(617) 270-8400 technical support
Sideways	(617) 497-6339
Sierra On-line	(206) 644-4343 Technical Support
Sigma Designs Inc.	(510) 770-0100
Sigma Support BBS Service	(510) 770-0111
Siler Systems	(503) 635-6333
Silicon Valley Computer	(408) 288-8837 GoldCard hard disk drive on a card
Sima Technology	011-886 2-557-8881
Simon & Schuster Interactive	(800) 983-5333
Sirius Pulishing	(602) 951-3288
Sir-Tech Software	(800) 447-1230
Smart & Friendly Computer	(800) 366-6001
Smart Micro	(800) 766-2467 AMI and Phoenix BIOS distributors
SofNet	(800) 370-8965 technical support
Softcraft	(800) 351-0500
Softeam	(213) 204-6620
Softkey	(800) 227-5609
Softklone	(904) 878-8564
Softlogic Solutions	(603) 644-5555
SoftSolutions	(801) 224-9000 technical support
SoftStyle	(808) 396-6368

Software Design Engineering	(714) 370-1330
Software Garden	(617) 332-2240
Software Masters	(317) 253-8088
Software Marketing Corp.	(602) 893-3377
Software Publishing	(408) 988-1703
Software Toolworks (Mindscape)	(415) 883-3300
Software Ventures	(510) 644-1325
Sony Corp. of America	(408) 894-0555 technical support (800) 222-7669 general information
Sony Electronic Publishing Co.	(800) 654-8802
Sota Technology	(800) 237-1713 (408) 745-1111
Southern California Systems, Inc.	(800) 237-7274
Spectrum Holobyte	(510) 522-3584
Spindrift	(708) 255-6909
Spinnaker	(617) 494-5261
STAC Electronics International	(619) 431-6712
Standard Micro Systems	(516) 273-3100
Standard Micro Systems	(516) 434-3162 BBS
Stanford Systems/786 Computer	(408) 435-2626
Star Micronics	(908) 572-3300 technical support
Star Micronics America	(212) 986-6770 headquarters (information)
StarPress Multimedia	(415) 274-8383
StarWare Publishing	(305) 426-4552
STB Systems Inc.	(214) 234-8750 various graphics adapters
Storage Dimensions	(408) 954-0710
Strategic Simulations Inc.	(408) 737-6800
Strategic Software Planning Corp.	(617) 577-8800
Structural Measurement Systems	(408) 263-2200
Studio Magic Corp.	(408) 378-3838
SubLogic	(800) 637-4983
Sumeria	(415) 904-0800
Summagraphics	(203) 881-5400 (203) 881-5318 main number
Summation	(206) 823-8688
Sundog	(718) 855-9141
Sun Microsystems	(408) 562-6000 (800) 786-0404
Sunol Systems	(415) 484-3322
Suntek Info. Inc.	(415) 657-0567
SuperMac Technologies	(408) 245-0646
Sutrasoft	(713) 491-2088
Swan Technologies	(800) 468-9044
SWFTE Intl. Inc.	(302) 429-8434 Glyphyx customer service (302) 429-9085 technical support
Symantec Corp.	(408) 252-5700
Symantec Norton Group	(310) 449-4900 technical support for Norton Utilities

Synergy	(800) 427-6100
Syracuse Language Systems	(315) 478-6729
Systems Compatibility Corp.	(312) 329-0700
Systems, Inc	(800) 237-7274
Systems Peripherals Consultants	(619) 693-8611
Take 2 Interactive Software	(212) 941-2988
Tall Tree Systems	(415) 493-1980 JLaser scanner & laser printer
Tallgrass Technologies Corp.	(913) 492-6002
Tally (Mannesmann Tally)	(206) 251-5500
Tandem Comp. Inc.	(800) 255-5010
Tandon Corp.	(805) 378-7861 technical support
Tandy Corp.	(206) 821-3047 repair center (817) 878-6880 accounting software (817) 878-6875 MS-DOS and hardware
Tangent Computer	(415) 342-9388
Tatung Company of America	(213) 637-2105
Taxan USA Corp.	(408) 946-3400
Tecmar	(216) 349-1009 sales information (800) 344-4463 technical support
Teknika Electronics Corp.	(800) TEK-NIKA
Tektronix	(800) 835-6100 technical support (503) 627-7111 main number
Telebyte Technology	(516) 423-3232
Telesys	(402) 489-5652
TeleVideo	(800) 835-3228 TelOAS/III comp.
Televideo Systems Inc.	(408) 745-7760
Tense Lectronix Corp. of Canada	(416) 474-1514
Tetragon	(214) 680-8134
Texas Instruments (TI)	(713) 274-2000 (800) 232-3200
Thomson Info. Systems	(213) 568-1002 Thomson EGA Ultra graphics board
3-D ROM Multimedia Inc.	(617) 628-8973
Tiara Computer Systems Inc.	(800) NET-IARA
Timebox	(613) 236-8969
Time Warner Interactive Group	(818) 955-9999
TITN Inc.	(415) 785-5970
TLB Solomon	(419) 423-3688 technical support
T/Maker	(415) 962-0195
Toptek Technology	(800) 416-8889
Torus Systems Inc.	(415) 594-9336
Toshiba	(800) 457-7777 (714) 837-4408 BBS
Total Vision	(310) 450-1315
Trade-Ventures Intl.	(800) 322-3464

Trantor	(800) 872-6867 main number
Trantor/Adaptec	(800) 959-SCSI technical support (408) 945-7727 BBS (1200, 2400, 9600 baud) (408) 957-7150 fax service support
Traveling Software	(206) 483-8088
Trident	(415) 691-9211
Trimark Interactive	(310) 392-3243
True Vision	(800) 858-TRUE
Tseng Laboratories Inc.	(215) 968-0502
Tsunami Media	(209) 683-WAVE
Turnpoint America	(702) 786-4484
Turtle Beach Systems	(800) 645-5640
TVM Corp.	(714) 985-4787
TW Technologies Inc.	(602) 581-0669
Ultra-Comp	(800) 435-2266
UltraStor	(510) 623-8955 technical support
UltraStor	(510) 623-9091 BBS for updated drivers
Ungermann-Bass Inc.	(408) 496-0111
Unisys	(800) 328-0440 hardware and software support
United Software Industries	(818) 887-5800
United Systems Company	(714) 832-3613
Unitek Systems Corp.	(312) 323-3395
Univation Inc.	(408) 263-1200 (408) 745-0180
USA*Flex	(800) 872-3539
U.S. Gold	(415) 693-0297
USRobotics	(800) DIAL-USR
Vectrix	(919) 288-0520
Velocity Development Corp.	(800) VLOCITY
Ventura Publisher	(800) 822-8221
Vericomp	(800) 234-1140
Verity Software House Inc.	(207) 729-6767
Verityper	(201)887-8000 x6433 technical support
Vermont Microsystems Inc.	(802) 655-2860
Vertisoft Systems Inc.	(803) 269-6422 technical support
Viacom New Media	(708) 520-4440
Victor Technologies Inc.	(215) 251-5000
Virgin Interactive Entertainment	(714) 833-8710 (714) 833-3305 BBS
Viridis Corp.	(310) 445-2055
Virtual Media Works	(408) 739-0301
Vision Enhancements	(602) 265-5665
VersaCAD Corp.	(800) 488-7228
Vivid Interactive	(818) 908-9663
VIXCOM Microsystems Inc.	(714) 859-9755
Vortex Systems Corp.	(408) 733-6900
Voyager Co.	(212) 431-5199
Vutek Systems, Inc.	(619) 587-2800
Wacom Corp.	(800) 922-6635
Wall Data	(206) 883-4777 technical support
Wang Laboratories, Inc.	(800) 247-9264

Wangtek	(805) 583-5255
Warner Music Group	(800) 693-3253
Wearnes Technology	(408) 456-8838
Weaver Graphics	(215) 884-9286
Weitek Corp.	(408) 738-8400
Western Digital Corp.	(714) 753-1234 hard drive support BBS (2400 baud) (714)753-1068 hard drive support BBS (9600 baud)
Whitewater Group	(312) 491-2370
Whole Earth Electronics	(800) 323-8080
Whole Earth (Mylex)	386 motherboard
Wilson WindowWare, Inc	(206) 937-9335 technical support
Wingz	(913) 492-9922 technical support
Wintek Corp.	(800) 742-6809
WordPerfect	(800) 228-1029 technical support: features (800) 228-6076 technical support: installation
WordStar Intl.	(404) 428-0008 technical support
WordStar Intl.	(404) 514-6332 BBS (9600 baud and lower)
WorksWare	(818) 989-2298
World Library Inc.	(800) 433-0238
Wyse Technology	(408) 473-1200 technical support
Wyse-Amdek	(408) 435-2770 automated support
Xerox	(800) 822-8221 (800) 832-6979 main number
Xiphias	(213) 841-2790
ZCI Publishing	(214) 746-5555
Zelos!	(800) 345-6777
Zenith Data Systems	(800) 227-3360 customer support (708) 808-4962 end-user BBS
Zenographics	(800) 366-7494
ZEOS Intl. Limited	(800) 228-5390
Zimos	(206) 454-8086
Z-Nix	(818) 332-1932 technical support
ZSoft Corp.	(404) 428-0008

Recommended Books

The ABCs of DOS 6.2 by Alan R. Miller (SYBEX)

Beyond the Limits: Secrets of PC Memory Management by Bob Campbell (SYBEX)

The Complete PC Maintenance & Upgrade Guide by Mark Minasi (SYBEX)

DOS 6.2: Everything You Need to Know by Jonathan Kamin (Prima Publishing)

Exploring the World of Online Services by Rosalind Resnick (SYBEX)

Free Electronic Networks by William J. Shefski (Prima Publishing)

The Hard Disk Survival Guide by Mark Minasi (SYBEX)

The Internet Unleashed (SAMS Publishing)

Microsoft Press Computer Dictionary by JoAnne Woodcock (Microsoft Press)

The Modem Reference by Michael A. Banks (Brady Books)

The New Hacker's Dictionary by Eric S. Raymond (MIT Press)

The PC Configuration Handbook by John Woram (Bantam Computer Books)

The Power of Windows and DOS Together by Martin Mathews and Bruce Dobson (Prima Publishing)

RX PC: The Anti-Virus Handbook (Windcrest/ McGraw-Hill Books)

Troubleshooting Windows by Mark Minasi (SYBEX)

The Whole Internet User's Guide & Catalog by Ed Krol (O'Reilly & Associates)

Windows 3.1: The Visual Learning Guide by David C. Gardner, Ph.D and Grace Joely Beatty, Ph.D (Prima Publishing)

Windows Secrets & Solutions by Alan Simpson (SYBEX)

The Winn Rosch Hardware Bible by Winn L. Rosch (Brady Books)

Recommended Periodicals

Computer Games Review, P.O. Box 1462, Lombard, IL 60148

Computer Gaming World, One Park Avenue, New York, NY 10016

Computer Shopper, One Park Avenue, 11th Floor, New York, NY 10016

CD-ROM Today, GP Publications, Inc., 300-A S. Westlake Drive, Greensboro, NC 27407

Electronic Entertainment, P.O. Box 59710, Boulder, CO 80323

Home PC, 600 Community Drive, Manhasset, N.Y. 11030

Multimedia World, P.O. Box 58690, Boulder, CO 80323

NewMedia, 901 Mariner's Island Blvd. Suite 365, San Mateo, CA 94404

PC, One Park Avenue, New York, NY 10016

PC/Computing, One Park Avenue, New York, NY 10016

PC Novice, 120 West Harvest Drive, Lincoln, NE 68521

PC World, 501 Second Street #600, San Francisco, CA 94107

Windows, One Jericho Plaza, Jericho, NY 11753

Windows Sources, One Park Avenue, New York, NY 10016

Online Services

Online Service	Phone Number
America Online	(800) 827-6364
CompuSserve	(800) 848-8990
Delphi	(800) 695-4005
Dow Jones & Co.	(609) 452-1511
GEnie	(800) 638-9636
Prodigy	(800) 776-3449
The WELL	(415) 332-4335

Boardwatch provides information about Bulletin Board Services nationwide. You can contact them by calling (303) 973-6038.

Computer Shopper includes an extensive list of nationwide BBSs and user groups designated by state. Contact them at One Park Avenue, 11th Floor, New York, NY 10016.

PC-Compatible GAME LOG SHEET

Title _____

Manufacturer Name _____

Address

City _____ State _____ Zip Code _____

Telephone Number _____

Fax Number _____

BBS _____

Online Forum on _____

Purchase Date _____

Place Of Purchase _____

Operates With MS-DOS _____ Windows _____

Microprocessor Required _____

Memory Requirements Conventional _____ Extended _____ Expanded

Disk Space Required _____

Stored On Diskette _____ CD-ROM _____

Video Mode _____ Video Driver Needed _____

Sound Setup Info: Sound Card Name _____ IRQ ____ DMA ____ Type____

Sound Types WAV _____ MIDI _____ VOC _____

Mouse Driver Needed _____ Version No. _____

Joystick Needed _____ Joystick Driver _____

Special Problems Encountered:

_____

_____

Notes:

_____

_____

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Manufacturer Name _____

Address _____

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Address _____

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Telephone Number _____

Fax Number _____

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Sound Types WAV _____ MIDI _____ VOC _____

Mouse Driver Needed _____ Version No. _____

Joystick Needed _____ Joystick Driver _____

Special Problems Encountered:

_____

_____

Notes:

_____

_____

PC Information

CMOS Setup Screen

Diskette A: _____
Diskette B: _____

		Cyl	Hd	Pre	LZ	Sec	Size
Hard Disk 1:	Type _____	____	_____	____	____	____	_____
Hard Disk 2:	Type _____	____	_____	____	____	____	_____

Base Memory: _____ KB
Extended Memory: _____ KB
Monitor Type: _____ Color Interlace _____
Video Card: _____ Keyboard: _____
CPU Speed: _____ Cache: _____
Processor Type: _____ Coprocessor Type: _____
Reserved Memory: _____ Segment _____ Size _____
BIOS Version #: _____ Video Mode: _____
Serial Ports: _____ _____ _____
Printer Ports: _____ _____ _____

Peripherals & Utilities

Add-On Peripherals

Sound Card _____ CD-ROM _____
Modem _____ Mouse _____
Scanner _____ Printer _____
Joystick _____ Other _____
Other _____ Other _____
Other _____ Other _____

Utility Programs

Compression Utility _____ Virus Scan Program _____
Backup Program _____ Disk Utility _____
Other _____ Other _____ Other _____
Other _____ Other _____ Other _____

Sound Card Configuration Information

HARDWARE CONFIGURATION

Description	Current Setting
Port Address	_____
Interrupt	_____
Game Port	_____
CD-ROM	_____

MIDI Setup

Description	Current Setting
MIDI Type	_____
Port Address	_____
Interrupt	_____

CD-ROM Setup

Description	Current Setting
CD-ROM Type	_____
IRQ	_____
Address	_____

CD-ROM Drive Information

HARDWARE CONFIGURATION

Description Current Setting

Name _____
IRQ _____
I/O Address _____
Device Driver _____ Directory Name _____ Loaded High ___
MSCDEX version _____ Directory Name _____ Loaded High ___
Sector Buffers _____
Connected To: Peripheral Card _____ Sound Card _____ External Port ___
CONFIG.SYS Line _____
AUTOEXEC.BAT Line _____

MS-DOS System File LOG Sheet

MS-DOS Version _____ Installation Date _____
Directory Location _____
Root Directory File List

File _____ Size _____ Date _____ Time _____
File _____ Size _____ Date _____ Time _____
File _____ Size _____ Date _____ Time _____
File _____ Size _____ Date _____ Time _____
File _____ Size _____ Date _____ Time _____
File _____ Size _____ Date _____ Time _____
File _____ Size _____ Date _____ Time _____
File _____ Size _____ Date _____ Time _____
File _____ Size _____ Date _____ Time _____
File _____ Size _____ Date _____ Time _____
File _____ Size _____ Date _____ Time _____

Directory List

Directory Name _____

Subdirectory _____ Subdirectory _____
Subdirectory _____ Subdirectory _____
Subdirectory _____ Subdirectory _____

Directory Name _____

Subdirectory _____ Subdirectory _____
Subdirectory _____ Subdirectory _____
Subdirectory _____ Subdirectory _____

Directory Name _____

Subdirectory _____ Subdirectory _____
Subdirectory _____ Subdirectory _____
Subdirectory _____ Subdirectory _____

Directory Name _____

Subdirectory _____ Subdirectory _____
Subdirectory _____ Subdirectory _____

Directory Name _____

Subdirectory _____ Subdirectory _____
Subdirectory _____ Subdirectory _____
Subdirectory _____ Subdirectory _____

CONFIG.SYS LOG SHEET

CONFIG. SYS File Lines:

Alternate CONFIG.SYS File Lines:

CONFIG. SYS File Lines:

AUTOEXEC.BAT LOG SHEET

AUTOEXEC.BAT File Lines:

Alternate AUTOEXEC.BAT File Lines:

AUTOEXEC.BAT File Lines:

File Backup LOG SHEET

Backup Program Name _____

Backup Date _____ Full Backup _____ Partial Backup _____
Backup Date _____ Full Backup _____ Partial Backup _____
Backup Date _____ Full Backup _____ Partial Backup _____

File _____ File _____ File _____
File _____ File _____ File _____
File _____ File _____ File _____
File _____ File _____ File _____
File _____ File _____ File _____

Directory _____ Directory _____ Directory _____
Directory _____ Directory _____ Directory _____
Directory _____ Directory _____ Directory _____
Directory _____ Directory _____ Directory _____
Directory _____ Directory _____ Directory _____

Backup Date _____ Full Backup _____ Partial Backup _____

File _____ File _____ File _____
File _____ File _____ File _____
File _____ File _____ File _____
File _____ File _____ File _____
File _____ File _____ File _____

Directory _____ Directory _____ Directory _____
Directory _____ Directory _____ Directory _____
Directory _____ Directory _____ Directory _____
Directory _____ Directory _____ Directory _____
Directory _____ Directory _____ Directory _____

Virus LOG SHEET

Anti-Virus Program Name _____

Virus Scan Date _____ Virus Found _____ Clean System _____

Virus Scan Date _____ Virus Found _____ Clean System _____

Virus Scan Date _____ Virus Found _____ Clean System _____

Virus Scan Date _____ Virus Found _____ Clean System _____

Virus Scan Date _____ Virus Found _____ Clean System _____

Virus Scan Date _____ Virus Found _____ Clean System _____

Virus Scan Date _____ Virus Found _____ Clean System _____

Virus Scan Date _____ Virus Found _____ Clean System _____

Virus Scan Date _____ Virus Found _____ Clean System _____

Virus Scan Date _____ Virus Found _____ Clean System _____

Virus Scan Date _____ Virus Found _____ Clean System _____

Virus Scan Date _____ Virus Found _____ Clean System _____

Virus Scan Date _____ Virus Found _____ Clean System _____

Virus Scan Date _____ Virus Found _____ Clean System _____

Virus Scan Date _____ Virus Found _____ Clean System _____

Virus Scan Date _____ Virus Found _____ Clean System _____

Virus Scan Date _____ Virus Found _____ Clean System _____

Windows Setup LOG SHEET

Windows Version _____ Installation Date _____

Video Display Driver _____ Mouse Driver _____

Default Printer Driver _____ Installed Printer _____

Installed Printer _____ Installed Printer _____

Installed Printer _____ Installed Printer _____

Windows Shell: Program Manager _____ Other _____

Swapfile Type _____ Size _____ Location _____

Startup Group Programs _____ _____ _____

_____ _____ _____

Screen Saver _____

Wallpaper _____

Critical WIN.INI File Lines

Load= _____

Run= _____

ScreenSaveActive= _____

ScreenSaveTimeOut= _____

_____

_____

_____

_____

Critical SYSTEM.INI File Lines

Shell= _____

_____

_____

_____

_____

[386Enh]

DMABufferSize= _____

32BitDiskAccess= _____

_____

_____

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